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A TREATISE

ON THE

SCIENCE AND PRACTICE

OF

MEDICINE

OR THE

PATHOLOGY AND THERAPEUTICS

OF

INTERNAL DISEASES

BY

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PATHOLOGY

AND

PRACTICE OF MEDICINE.

DISEASES OF THE RESPIRATORY SYSTEM.

THIS subject embraces the affections of the lungs and their appendages—the larynx, trachea, bronchi, pleura, and the bronchial glands.

A knowledge of the anatomy and physiology of these organs is supposed to be possessed by one who undertakes the study of their diseases. If, however, the reader is not fresh in this knowledge, he is advised to review it by referring to the works on anatomy and physiology. The position and structure of all these organs, and the mechanism of normal respiration, must be clearly in the mind, or much that is to follow, especially on physical diagnosis, will not be readily understood. A knowledge of all diseased conditions is based upon that of the healthy states ; but it would extend a work on the practice of medicine too much to enter upon anatomical and physiological details.

Before entering upon a particular description of the diseases of the respiratory system, some topics require attention which relate to these affections, and which will be more advantageously considered in a separate article. They are the *physical signs* and the *symptoms* which are peculiar to these affections.

A distinction is usually made between physical signs and rational symptoms, but the line of demarkation is not definitely and clearly drawn. The expectoration and its appearances are, for instance, placed among the rational symptoms, but might with equal propriety be considered among the physical signs. All morbid symptoms, when properly interpreted, become *signs* of pathological states ; but they

are called "physical" only when structural changes or material substances are produced and are discoverable by physical means, or where mechanical principles are concerned.

PHYSICAL DIAGNOSIS.—PHYSICAL SIGNS OF DISEASES OF THE RESPIRATORY ORGANS.

By *Physical Diagnosis* is understood methods of detecting by physical means, during life, anatomical or physical changes produced by disease. Strictly speaking, it includes also the physical means of distinguishing normal conditions, with reference to determining the presence or absence of certain morbid states. It is an art which has been developed by witnessing and studying certain physical phenomena in the course of diseases, and by observing, on *post-mortem* examination, the changes and states which exist and which have given rise to the phenomena that were present during life. A long course of clinical and dead-house observations, aided by the principles of natural philosophy, has resulted in the establishment, on a scientific basis, of a large number of relations between external physical phenomena and internal structural conditions.

The most important of these are now to be briefly presented, so far as they relate to diseases of the respiratory organs.

Physical diagnosis, as applied to the breathing apparatus, has these six methods: inspection, palpation, mensuration, percussion, auscultation, and succussion. In addition to these, spirometry and laryngoscopy are means of investigation, the latter, especially, being one of much importance in diseases of the epiglottis, glottis, and larynx.

The signs elicited by these methods are nearly all objective—are observed by the physician—and only the pain sometimes produced by percussion is subjective, or felt and expressed by the patient.

In making physical examinations, the three senses of sight, touch, and hearing are brought into requisition to determine the condition of the chest and its contents.

These means show many conditions, such as size, solidity, the presence of fluids, obstructions, etc., with great certainty; and the knowledge thus directly obtained is more satisfactory than that which is derived from many of the statements of patients.

There are, however, limits to the diagnostic value of these means. While the grosser changes and conditions are so positively shown, many of the minuter pathological states are not distinguishable by them.

A consolidation of a lung may be detected by percussion, but this alone will not indicate whether this consolidation is from inflamma-

tory exudates or from some other material. A fluid in the chest may be detected by physical signs, but those signs will not indicate whether that fluid is pus or serum. The physical signs, however indispensable the knowledge they afford, need to be supplemented by the rational symptoms, the history of the case, and by much particular pathological knowledge, to make the art of diagnosis as perfect as it may be.

The point of departure—the standard of comparison in physical exploration, as in every other mode of investigating disease—is the physiological state, the conditions and the signs of health. Diseased conditions and signs are deviations from these, and the standard must be clearly understood before the deviations can be observed and the comparisons made. The first object, therefore, will be to describe the signs of health.

Sounds are the most important means of physical diagnosis. Auscultation and percussion are far more useful than the other methods in the investigation of diseases of the chest, and the first is conducted entirely, and the second chiefly, by means of sounds. It is essential, therefore, that the properties of sounds should be clearly understood, and that the ear should be trained to their recognition.

There are, doubtless, great differences in the perception of sounds by different persons, as there are differences in the perception of colors. Some are color blind—incapable of distinguishing some colors from others; and so some are incapable of distinguishing the various characters of sounds; but the sense of hearing, with reference to such distinctions, is capable in most persons of great development by attention and cultivation. One who aspires to be an expert in physical diagnosis must cultivate his sense of hearing, not to the same extent, but to some extent, as the musician learns to tune his instrument.

Sounds differ from each other in several respects, and the perception of those differences leads to their distinction. They differ in *intensity* or loudness; in *duration*; in *pitch*; and in *special quality*. They are also modified in character by the distance of their sources from the ear. Each of these properties is to be conceived of and studied.

By *intensity* is understood simply loudness, or the distance at which a sound may be heard—the force of the vibrations which reach the perceptive auditory centre. It has reference to no other quality, as the term is used in physical diagnosis.

By *duration* is meant the length of time a sound continues. Most solid bodies when struck emit a short sound; while hollow ones, or those more vibratory, produce longer sounds. Striking a stone and a gong illustrates this.

The term *pitch* is not so easily understood by those who have not studied the subject of acoustics or the science of music. It has reference to the frequency of vibrations of the sound-producing body, or the highness and lowness of the sound. The short, small, tense string of a piano or a harp when struck vibrates rapidly and produces a high-pitched sound; while the larger, longer, and looser string vibrates more slowly, and produces a low-pitched sound. The adult male bass voice is low pitched; while the child or female voice is high pitched.

The *special quality* of sounds is that by which they are distinguished from each other, independently of loudness, duration, or pitch. Every sound has its own peculiar quality, dependent upon the character or manner of the vibrations of which it consists or which produce it, irrespective of their intensity, their frequency, or the length of time they continue. Thus two musical instruments, as a violin and a flute, though sounding the same note—producing vibrations of equal rapidity, of the same intensity (heard at an equal distance), and continuing the same length of time—are still readily distinguished from each other. They are thus distinguished by their *special quality*, which is independent of everything else.

The modifications of sounds produced by distance, which enable us to judge of the place of their production, may not easily be explained, but the fact of our being able to form such judgment is well understood. In this, however, we are liable to be deceived. A loud sound produced at a distance sometimes appears like a feebler one nearer by. Generally, however, the judgment based upon experience approximates correctness, and gives information upon which we can rely.

Some sounds are continuous, and others are interrupted. Some again are regular, and others irregular in their variations; and different combinations and successions in these and other respects determine the agreeableness of musical sounds, or the disagreeableness of noises.

It is difficult to convey an idea of many of the characteristics of sounds by words, as it is of colors, without some definite and well-known standard with which they can be compared. This renders the listening to sounds, as the seeing of colors, essential in order to their proper understanding.

In studying the sounds of the chest, whether in listening to those produced by the respiratory movement, or to those elicited by percussion, these different properties of the sounds must be observed; and in describing them with accuracy the terms indicating the different properties must be used. This renders a mention and conception of them in this connection essential.

For the convenience of locating the different signs in records and

descriptions, the surface of the chest has been divided into different regions.

The first general division is into anterior, posterior, and lateral aspects. The further divisions are expressed in the following tabulated form :

Anterior aspect on each side	{	Supraclavicular.
		Clavicular.
		Infraclavicular.
		Mammary.
		Inframammary.
Between these	{	Suprasternal.
		Superior Sternal.
		Inferior Sternal.
Posterior aspect on each side	{	Superior Scapular.
		Scapular.
		Infrascapular.
		Interscapular.
Lateral aspect on each side	{	Axillary.
		Infra-axillary.

The boundary of these regions is as follows : The supraclavicular region of the chest is that above the inner half, or a little more, of the clavicle ; the clavicular, the inner half of that bone ; the infraclavicular, below the clavicle to the level of the third rib ; the mammary, from the third to the sixth rib ; and the inframammary comprises the remainder of the front of the chest. The suprasternal part is that immediately above the sternal notch ; the superior sternal, the upper half ; and the inferior sternal, the lower half of the sternum. The axillary region includes the parts between the axillary folds, and the parts beneath, extending half-way down the chest ; while the lateral part of the chest below is the infra-axillary. Behind, the superior scapular region is that above the spine of the scapula ; the scapular, more particularly that part which immediately includes its spine ; while the infrascapular is the part below the scapula. As this bone, however, is movable, the boundaries of the scapular region are not exact. The interscapular region is the part between the scapulæ, which is a variable space depending upon the position of the scapular bones.

The first method of physical examination is by *Inspection*. This is looking at the chest with care and precision, and noticing all the

visible peculiarities. Inspection reveals two classes of facts—*statical* conditions, or the state of the parts at rest ; and *dynamical* conditions, or the actions of the parts—their conditions in motion.

Inspection of the statical state shows the size, capacity, relations to the height of the body, the general shape, the symmetry, etc., of the chest ; while inspection of the dynamical state shows the character, frequency, and extent of the respiratory movements, including often the visible pulsations of the heart, etc.

The normal shape and proper symmetry of the chest need not here be described. There are often abnormalities independent of any disease of its contents. In rickets and mollities ossium, and as the results of particular occupations and habitual positions, or of curvatures of the spine, the symmetry of the chest may be destroyed, and percussion notes may be modified, without internal disease.

A condition called pigeon-breast, commonly the result of cough, enlarged tonsils, or other causes of dyspnœa in childhood when the bones are soft and plastic, consists in an undue prominence of the sternum, and flattening of the ribs of the upper and anterior part of the chest, with a contracting or drawing in of the lower ribs. These deformities affect the shape of the lungs, and may have an influence upon their density and expansion in particular parts, but commonly produce effects of no other kind.

Various other deformities are sometimes observed. A transverse furrow, passing downward from the end of the sternum and the lower anterior surface of the chest, is due to imperfect expansion of the lungs during early life. The alar chest is one in which from its narrowness or particular shape the scapulæ project, suggestive of wings. It is often due to the drooping of the shoulders ; the spine of the scapulæ has an oblique direction downward, and the inferior angle is tilted upward and outward. This may be due to simple weakness of muscles, or to native formations, though it often occurs in cases of chronic phthisis.

Flat chests, sometimes—but by no means always—the result of disease, are observed, and in fact no two chests are exactly of the same shape and proportions, some varying much from the most common form.

The emphysematous or barrel-shaped chest is very peculiar, and results from the long continuance of emphysema. But this will be described more particularly in connection with the account of that disease.

Of other statical states discoverable by inspection we may have *Expansion*, which indicates a general enlargement, commonly of one side of the chest ; and *Bulging*, which is a local enlargement or projection—

an expansion limited in area. In various morbid conditions, which will be hereafter described, such as effusions, deposits, tumors, emphysema, etc., local or more general enlargements occur.

Diminution in size—contraction or wasting—is also sometimes the result of disease.

Retraction is the opposite of expansion, and indicates a diminution of a large portion—generally one side of the chest—while *depression* is the opposite of bulging, and indicates the falling in of a more limited portion.

Among the *Dynamical* conditions to be observed by inspection, the frequency of respiration is important. In health, and when at rest, the respiration of the adult is from eighteen to twenty per minute. In disease of the respiratory organs it may be from thirty to sixty. The normal ratio of pulsation and respiration is about four or five to one. The ratio is not materially changed in fever or exercise, or by causes acting equally upon the lungs and heart. In disease which diminishes the capacity of the lungs, and in most cases of dyspnoea, the frequency of respiration is increased more than that of the pulse, and the ratio is changed.

Inspection also shows the relation of inspiratory and expiratory movements—their regularity and rhythm. One may be shortened or lengthened more than the other; inspiration especially, in cases of dyspnoea, may be shortened by more violent instinctive or voluntary efforts, while expiration is normal, or at least less affected. In obstruction in the upper air passages inspiration and expiration may both be prolonged and laborious; and in some cases of deficient elasticity of the lung tissue or the chest walls (as expiration is ordinarily effected chiefly by the elasticity of the parts after expansion beyond their ordinary statical state) expiration is prolonged. Not only the relations of inspiration and expiration may be changed, but the regularity of either of these movements may be destroyed. The inspiratory movement may be hitching or interrupted—one part may be slower and another faster than normal—the natural rhythm being lost.

Inspection again shows the relation of the abdominal and costal movements in the act of respiration. When there is fullness of the abdomen preventing the descent of the diaphragm, or where there is disease of structure in the lower part of the lungs, preventing free expansion there, respiration is more than ordinarily effected in the upper part of the chest and by the motion of the ribs; and the costal will exceed the diaphragmatic and abdominal movements.

Aside from diseases, any restriction about the lower part of the chest, by tight dress or otherwise, will cause the respiration to be

chiefly costal and in the superior part of the lungs, and the upper costal movements will then be increased. Normally, at least in some physiological conditions, abdominal respiratory movements are less in women than in men, while the extent of the costal movements is reversed.

In addition, inspection will show whether the respiratory movements are easy or difficult, feeble or forcible, free or constrained ; and the length of each movement may be estimated and recorded in seconds.

Various changes from the normal statical and dynamical conditions may occur in different diseases. For example : *Expansion* occurs in pleuritic effusions, hydrothorax, pneumothorax, and emphysema.

Local bulging occurs in aneurism of the aorta, hypertrophy of the heart, pericardial effusions, abscesses and tumors of the lungs, etc.

Retraction of the chest takes place in absorptions after effusions, and where adhesions and other changes have occurred which prevent expansion of the lungs.

Depression often follows pleuropneumonia from contraction of adhesions or of fibrous connective-tissue structures ; and also after abscesses, in interstitial pneumonia, in tubercle, etc.

There are diminished respiratory movements in pleurisy, hydrothorax, pneumonia, tubercle, obstruction of the bronchi, etc., in the side or part affected ; while they will be increased in the parts which are free ; and sometimes, where there is great obstruction and a severe sense of dyspnoea, violent agitating efforts will be made to obtain air. Increased elevation of ribs, increased descent of diaphragm, but without corresponding passage of air into the lungs, and consequent depression of the intercostal spaces, and a narrowing of the chest from atmospheric pressure may occur in asthma, croup, spasm of the glottis, and other obstructions in the larger air passages.

Abdominal respiratory movements are increased in diseases which diminish the breathing capacity of the upper part of the lungs, while the lower part is more free. Thus in tubercle, inflammation, etc., of the upper lobes, abdominal respiration will be comparatively increased, while in effusion occupying the lower part of the chest, or in pneumonia involving the lower lobes, the respiration will be more by the motion of the upper ribs.

An additional method of diagnosis by the sense of sight, applicable to the larynx, and to some extent to the trachea, is by means of the laryngeal mirror, or laryngoscope, already mentioned. This is based upon a different principle from that of the inspection of the outer chest and the inferences drawn of the condition of parts hidden from the sight. By this instrument inspection is made of the diseased part itself, and its conditions are seen by the reflection of the mirror, as we see external diseases. The apex and a considerable portion of

the epiglottis may often be seen by merely looking into the throat when the mouth is widely opened and the tongue well depressed. When the tongue is thrust out, and a spatula with a fenestrum or a somewhat concave and roughened surface is placed far back, the tongue somewhat drawn forward when depressed, and the patient placed in a good light, a good view of the conditions of the epiglottis and also of the deeper parts of the pharynx can often be obtained. The laryngoscope, however, not only enables these parts to be more clearly seen, but renders it possible to determine the conditions of the larynx with the utmost precision, and to employ local measures with intelligence and accuracy.

Various particular instrumental contrivances, more or less elaborate, are used in these examinations, but the essential principles in all are the same.

As the student will easily find full descriptions of these instruments, and the mode of using them, it will only be necessary here to give the briefest description of the simplest contrivance and indicate the principle of its use. There will be required a lamp yielding a steady light, with some form of reflector or condenser, so that a strong light may be thrown upon a circular concave mirror, three or four inches in diameter, with a focal length of twelve or fourteen inches, freely movable in all directions upon its support. The lamp is to be placed by the side and a little behind the patient, and the concave mirror upon the forehead of the examiner, or over one of his eyes, and in the latter case there must be an opening in the centre through which to look ; or at all events the mirror must be placed in such a position that a strong, concentrated light is thrown into the throat to thoroughly illuminate its interior. A laryngeal mirror of a proper form, from half an inch to an inch in diameter, attached to a handle with a slender stem six or eight inches long, and at an angle of about 120° , is an essential part of the apparatus. In making an examination the mouth should be widely opened, the tongue drawn forward and depressed, and, with light thrown strongly into the throat, the laryngeal mirror should be so held as to receive and reflect an image of the parts to be inspected. An image of the glottis, the interior of the larynx, and even to some extent of the trachea, the vocal cords, etc., and any morbid growth, ulcerations, or other diseased conditions can be observed. There are often difficulties in the management of the instrument, and particularly so in the case of children, and its proper use requires care, the observance of certain rules, a degree of manual dexterity, and some experience.

The morbid conditions which may be detected are congestion, inflammation, swelling, œdema, exudations, ulceration, morbid growths,

paralytic or spasmodic conditions of the vocal cords, and compression of the trachea by aneurismal or other tumors.

The larynx and trachea may be examined from without by the eye and the touch, observing their tenderness, their deviation from the mesial line by the pressure of tumors, and the condition of surrounding parts.

Mensuration, or measurement of the chest, shows many of the same facts which are observed by inspection, but shows some of them with more precision and certainty. By inspection an increase or diminution of the size of a part may be observed, but not with sufficient precision for record. This must be determined by measurement. It may often be readily seen that one side of the chest expands more in inspiration than the other, but precisely how much more can only be determined by some such process as placing a tape measure or some inelastic fillet around the chest, bringing the two ends to the centre of the sternum at the time of expiration, then compressing the tape on a spinous process, and observing and marking the distance each end recedes from the centre of the sternum during inspiration. One side of the chest in pleuritic effusion may readily be seen to be larger than the other; but a tape brought from a spinous process to the centre of the sternum around one side, and then around the other, will show how much larger at that point one side is than the other. These are illustrations; but the chest may be measured in every direction, and comparisons made between one side and the other, and the amount of change which may occur from time to time may be recorded.

There are various instruments and contrivances for measuring the chest—callipers for determining the antero-posterior or lateral diameters, etc.; but a simple tape measure is all that is essential in ordinary cases.

Palpation, or the application of the hand to the chest, employs another sense, that of touch, to distinguish the conditions observed by the sight and determined by measurement. It, in addition, distinguishes a peculiar vibratory motion produced by speaking or by coughing, called the vocal or tussive *fremitus*. What is called a rhonchal *fremitus* is occasionally observed, especially in children, produced by the air in breathing passing through mucus in the bronchi or trachea; and also in rare cases a rubbing vibration may be felt in pleurisy by respiratory movements, and in pericarditis by the movement of the heart. Palpation also gives a knowledge of the hardness or softness of parts examined, and of the fluctuations of fluids within the cavity of the chest or its parietes. The touch conveys very accurate information, especially when the sense is properly cultivated. The form, the bulgings, and depressions of the surface of the chest, are readily discovered by the application of the hand, confirming the evidence

of the sight ; but its chief advantage is in discovering and estimating the vocal *fremitus*. When the hand is applied to the chest during speaking, the vibrations of the voice, communicated chiefly through the trachea and the bronchial tubes, are extended to the thoracic walls and are felt in a tremulous motion. The stronger the vibrations of the vocal cords the greater is the motion conveyed to the walls of the chest, and the more distinctly are they felt. The quality and loudness of the voice modifies the palpable sensation, and the condition of the lung as to its solidity has a material effect in modifying the *fremitus*. Speaking in a bass voice produces more vibration than in one of a high pitch. From the size and position of the primary bronchial tubes, more *fremitus* is felt on the right than on the left side of the chest, especially in the upper part ; and any degree of consolidation, while the tubes remain open and free, generally increases the *fremitus*. Increased vocal *fremitus* becomes, therefore, one of the signs of pulmonary consolidation. It is correlative with other signs, and often confirms the evidence they afford.

The vocal *fremitus* is lessened or suppressed when there is a free liquid effusion, or air in the chest, which removes the lung from the walls, and its absence consequently becomes an evidence of these conditions.

The vocal *fremitus* usually corresponds to the vocal resonance, or the sounds of the voice heard when the ear or stethoscope is applied to the chest.

In obstruction of the bronchial tubes of a part, both the vocal *fremitus* and vocal resonance are diminished.

The impulse of the heart is sometimes felt at a little distance from that organ, when consolidation of the lung surrounding it is present ; and the pulsations of an aortic aneurism, sometimes of cancerous tumors, and rarely of a pneumonic inflammation, may be felt.

Succussion, or the shaking of the body to elicit sound, is only applicable in diseases of the chest where there is air and a liquid in the pleural sac or in a cavity of the lung. A splashing sound may be elicited by shaking or a sudden movement. When there is liquid or air alone, such sound cannot be produced ; hence it is not heard in simple pleuritis or pericardial effusion, and the noise often produced by succussive motion in the lower part of the left side is produced in the stomach, where liquids and gases are frequently mingled.

Percussion is a more important means of physical diagnosis than any of the others which have just been described. It consists in striking upon the chest and thus eliciting sounds, and its indications are obtained by observing the character of the sounds ; and also by noticing the degree of resistance felt, and subordinately through the sensations of the patient the tenderness or unusual feelings in the chest.

Percussion shows the degree of solidity, of elasticity, of resistance, and of soreness. The solidity and elasticity are discovered chiefly by the sounds produced, but to some extent by the resistance felt. The comparative information afforded by each of these senses of hearing and touch, will depend much upon the cultivation and the attention given to them respectively.

The *methods* of producing percussion are various. Percussion was first practiced by striking directly upon the chest. Then it was found that by interposing some substance called a pleximeter between the chest and the percussing agent, a better sound could be elicited, and with less force than by striking the part directly. The simplest method, and that most frequently used, is to apply the palmar surface of the middle finger of the left hand to the walls of the chest as a pleximeter, and to strike upon it with the ends of the fingers of the right, placed so as to form a straight line. In striking an elastic blow by the motion of the wrist rather than of the arm, and removing the percussing fingers as soon as the blow is made, a sound is brought out, the vibrations of which come from the lung substance, and indicate its peculiar character.

Other pleximeters than the finger are used, such as pieces of ivory or hard rubber, but nothing resembles so much the walls of the chest, and nothing aids in the production of so natural a sound as the finger used as a pleximeter. Various percussing instruments have been used, such as hammers covered with or composed of rubber; but nothing I have seen used brings out so clear, so full, and so natural a sound as a common stethoscope with a groove around the margin of the ear-piece in which is placed a ring of rubber, while the finger is used as a pleximeter. This I have used for many years, and nothing has satisfied me so well.

Various rules must be observed in making percussion. The position of the patient is important. The best is a sitting or standing one. If lying (in some cases of severe illness the only practicable position), the patient must rest upon a uniform surface, which has the same quality in every part of reflecting sound. This is important in leaning against a surface in the sitting or standing position. Standing with the back against a door, or some similar surface, increases the sound; but care must be taken that the back rests equally upon each side, and that the parts upon which the two sides rest are equally sonorous. This point is repeated because of its importance, and because of the mistakes that are liable to occur, in comparing the two sides, by neglecting it.

The position of the body and its parts should be such as to make the muscles upon the walls of the chest as firm, tense, thin, and

equable as possible, or as is convenient. At all events the muscles on the two sides (and the sides here as elsewhere must always be compared) must be in an equal state of tenseness, otherwise the sound may be varied by the different conditions of the walls of the chest, without there being any difference in the state of the lungs beneath.

Percussion is best made by placing the pleximeter on the naked chest; though a thin, single, smooth and uniform covering may be allowed. For the sake of delicacy, in women, this may be required; though by exposing only a small part of the chest at a time, percussion may be practiced without impropriety upon the naked surface, in all cases where doubt exists and a careful examination is required.

The pleximeter must always be placed evenly and firmly upon the chest, and made, as it were, a part of its walls. Neglect of this rule will make the greatest difference in the sounds elicited.

In comparing different parts of the chest, the same external conditions must be preserved.

The percussion stroke should be an elastic, not a pushing one; and its direction should be perpendicular to the walls of the chest.

As a rule, only a gentle force is required, but the blow must be stronger when the object is to bring sounds from the deeper parts.

Every object when struck upon produces vibrations, and consequent sounds peculiar to its own structure; each part of the body has its own peculiar percussion sound; and each sound has intensity, pitch, duration, and special quality, giving it its individual characteristics. These properties are to be carefully observed; and the student who expects to be an expert in physical diagnosis must make himself familiar by practice with the sounds which can be elicited by percussion upon different parts of a healthy person.

The lung sound is most important. It is very characteristic—entirely unique, and is typical in health in the infraclavicular region, in the axilla, and in long-chested persons particularly, in the infra-scapular region.

From its peculiar quality, suggestive of the vesicular structure of the lungs, it is called the “*normal vesicular resonance*.”

The peculiarity of lung sound is obscured in the supraclavicular region, except near the middle—on the outside by the tissues of the shoulder, and toward the mesial line by the harder and more hollow sound from the trachea. The percussion sound of one body is modified by its proximity to others; and the sounds on the two sides of the chest differ, especially in the lower part, by the presence of the solid liver on the right, the heart, the spleen, and the stomach on the left. Over the sternum the sound is hard, modified by the solid bone

superficially, and a part of the heart and the large vessels more deeply. The percussion sound of the lungs has a certain *intensity* proportioned to the force of the blow, the volume of the lung, the thickness, tensity, and other conditions of the chest walls and coverings, and the proximity of other organs. The *pitch* is *low*, compared with the more solid and tense parts of the body; and its special quality is peculiar. As there is no other structure like the lungs, so there is no percussion sound which is the same. Different healthy lungs, however, from their differences of size, of individual structure, and from the differences of their coverings and surroundings, furnish slight differences in their percussion note, and there is no exact and absolute standard. The sounds are not equal on the two sides below, for the reasons stated, and even in the upper part there are very slight differences in most persons, and in some the differences here are very distinguishable to an expert observer. The left side has a little more of the pulmonary resonance, which is accounted for by the difference in the size and arrangement of the primary bronchi in the two sides, by the presence of the large solid liver on which the right lung rests, by the more hollow stomach in the concavity of the diaphragm on the left, and in right-handed persons by the greater thickness often of the right pectoral muscle. In many persons the difference in the upper part of the two lungs is scarcely distinguishable; but it is very important, in order to avoid serious and annoying mistakes, to know that this difference in many cases exists. A synopsis of the percussion sounds in different parts of the chest in health, is given from the work of R. E. Thompson, M. D., senior asst. physician to Brompton Consumptive Hospital. (Page 61.)

Vesicular sound.	Resonant...	{	Infraclavicular, right and left.
		{	Clavicular, right and left.
		{	Supraclavicular, right and left.
		{	Upper axillary, right and left.
		{	Infrascapular to eighth rib.
	Sub-resonant	{	Mammary, right.
		{	Suprascapular, right and left.
		{	Scapular, right and left.
		{	Interascapular, left.
	Diminished.	{	Mammary, left.
		{	Lower axillary, right.
		{	Infrascapular, right and left.
		{	Inframammary, right.

Tracheal sound.....	{	Upper sternal.	
		Infraclavicular, near sternum.	
		Interscapular, right.	
Tympanitic resonance...	{	Lower axillary, left.	
		Inframammary, left.	
Dullness.....	{	Inframammary.	} Right over liver.
		Lower axillary.	
	{	Infrascapular.	} Right and part of left over spleen.

The thymus gland in children may produce some dullness from a little above the sternal notch down to the fourth cartilage. The particular percussion notes are varied in their outline or boundaries by inspiration and expiration. As the lung expands in inspiration the pulmonic note is heard lower down. It is also varied in quality by a very full inspiration. The tenseness of the lungs, when extremely expanded, gives a somewhat muffled character and a higher pitch to the note, affecting similarly all parts of the lungs.

It seems hardly necessary to repeat, but it is exceedingly important for the student in physical diagnosis to bear in mind, that the signs of health, the natural sounds, are first to be thoroughly studied, as the morbid ones are but deviations from these—deviations in intensity, pitch, duration, and special quality.

It is impossible to express in words the character of the percussion note from a healthy lung, as there is nothing with which it can be particularly compared. As stated, it has a certain degree of intensity, a certain duration, a certain pitch, and a very peculiar special quality. It must be heard in order to be understood, and among the first necessities of the learner is to produce the sounds on a healthy chest and become familiar with them.

The shades of appreciable variation from the most normal standard of the pulmonary percussion note are very numerous, but the more marked variations are grouped by authors under various heads.

The terms Resonant, Hyperresonant, Tympanitic, Amphoric, Metallic, Subresonant, Muffled, and Dull, are often used, and have a technical meaning.

The student can perhaps receive a more distinct impression of the best recognized deviations from the normal sounds by considering them under the following heads :

1. The first deviation is *Exaggerated Vesicular Resonance*. In

this, the vesicular quality—the difference from percussion sounds on other parts of the body—is greater than that of the normal lungs. It occurs in emphysema, where the air vesicles are expanded, the lungs occupying more space, and where there is less solid matter in a given area than in the healthy lungs. More of the lung tissue is occupied with the air vesicles, and the sound elicited is therefore more vesicular in quality, though in some cases it approaches the tympanitic character. The intensity of the percussion note is greater, the pitch is lower, or at least more open, the length is increased, and the quality is softer; and besides this, the resistance felt by the hand of the percussor is generally less. The sound and the feeling is somewhat more like striking upon a hollow, sonorous body, than upon a solid one, or upon healthy lungs.

When obstructive disease exists in one lung, or one part of a lung, the unobstructed portion is apt to be more distended with air, and without emphysematous disease the sound on percussion may be a slightly exaggerated vesicular resonance.

2. The second deviation is *Diminished Vesicular Resonance*. This is commonly called dullness. There are different degrees of this, but all have something of the vesicular quality—of the pulmonal character—of sonorousness indicating the presence of lung; there is *not flatness*, such as is produced by striking over a solid organ, as the liver.

The terms subresonant and muffled resonance indicate moderate degrees of this change, while the term dullness without qualification indicates a greater degree of the change.

This diminished vesicular resonance indicates a diminution of air in the lung, and a diminished elasticity of the part, and an increase of solids or liquids. It is observed where there are inflammatory exudations, tubercular deposits, œdematous effusions, intense congestion, or collapse of the lungs; where there are large accumulations in the bronchial tubes, or where there are moderate accumulations of fluid or a free deposit of false membrane in the pleural cavity. The sound approaches but does not reach that produced by striking over a solid body. Should it do so, it would be brought under the next division of abnormal percussion sounds.

In diminished vesicular resonance or dullness, the intensity of the sound is diminished, the pitch is *higher*—the vibrations shorter and more rapid—the duration is less, the quality is harder and less vesicular.

This is the most common and most important of the deviations, and requires to be thoroughly understood.

3. The third deviation is that of *Flatness*. In this there is no

vesicular quality—none of the peculiar lung sound. It is like that produced by striking over a solid organ, as the liver, or upon the thigh. It occurs where large effusions in the cavity of the pleura have removed the lung; in complete consolidation of the lung and the bronchial tubes in a part (for if the air vesicles are filled with solid matter, while the numerous bronchial tubes are filled with air, a degree of resonance is preserved), and in large tumors occupying lung space.

In flatness, the intensity or loudness of the sound is still less than in dullness, the pitch higher, the duration shorter, the quality harder, and the deviation from the vesicular quality more complete.

4. The fourth is that of *Tympanitic Resonance*. This is a drum-like resonance, destitute of the vesicular quality, and indicating a cavity of a comparatively large size filled with air. It is typical in pnenmothorax. Here the intensity is greater than in the healthy state, the pitch is generally rather high, the duration is prolonged, the resistance variable, depending upon the tenseness of the distention, the quality being hollow.

5. *Amphoric Resonance* is the appellation used to designate the variation from the normal percussion sound of the lung, when it resembles that of filliping the cheek moderately distended with air. It has frequently the addition of a musical overtone, or a more or less marked echo; when distinctly like the filliping of the distended cheek, it indicates a cavity near the surface of the lung, with flabby walls. It is heard chiefly in the latter stages of phthisis, and when thus heard will confirm the diagnosis of destruction of lung tissue, which other signs and symptoms have enabled the observer to make. The cavity must contain air without much fluid, and must have an opening into a bronchus.

When a more sonorous ring is heard, with a distinct musical echo, the air is likely to be in the pleural cavity outside the lung.

The cavity is generally larger, and has an opening through the lung communicating with a bronchial tube.

6. The *Cracked Metal* percussion sound resembles in some respects the amphoric. Both have a tympanitic character, but the latter especially on a small scale. Both indicate a cavity near the walls of the chest, and the clinking metallic sound, which gives the latter its name, is produced by the driving together of the walls of the cavity by the percussion blow; on the same principle a similar sound is produced, by placing the palms of the hands together so as to form in the centre a cavity, and forcing the surfaces in contact by striking the hands over the knee. There are some exceptions to the indications of both these signs. A bronchus of some size, and especially if

dilated, covered by a portion of solidified lung reaching to the chest wall, may yield an amphoric resonance ; and, in rare cases, in healthy children with elastic and yielding chest walls, the surfaces of the larger bronchial tubes may be driven together and produce the clinking sound.

7. The last deviation to be named is the *Vesiculo-tympanitic*. In this, as the name implies, there is a combination of the normal vesicular and the drum-like sound. It is, however, louder than the normal, the pitch is higher, the duration prolonged, and the quality is more hollow. It is produced in extreme emphysema, especially where very much distended air cells are near the surface of the lungs.

On percussion, a sound sometimes called tympanitic and sometimes vesiculo-tympanitic, is observed in the upper anterior part of the chest in pleuritic effusion, where the lower part of the chest is occupied by fluid and the lung is compressed and floating upon its surface above. The tympanitic character of the sound is marked, though it is not quite as ringing and hollow, and not strictly typical as in pneumothorax. It may, therefore, be called vesiculo-tympanitic.

The explanation of this more hollow and drum-like sound, elicited over a lung which must be compressed, appears difficult, and has given rise to different opinions.

Skoda found that a lung out of the body, deprived of a part of its air, gave a clear percussion note, approaching the drum-like character, and this can be demonstrated at any time by striking upon a healthy lung naturally collapsing after removal from the chest. This sound, however, is not as distinctly tympanitic as that elicited over the living lung floating upon a fluid below and compressed into the top of the chest cavity. Others have thought the sound due to the expansion of the chest by the projection of the ribs caused by the fluid below, and that air vesicles were actually expanded. This can hardly be true, and to my mind is entirely unsatisfactory, though when the cavity of the upper part of the chest is thus expanded it may contribute somewhat to the character of the sound.

In my judgment it is due to the large collection of bronchial tubes occupying the space, and also to the diminution of blood in the vessels of the lung caused by the compression : and the surface of the fluid below may reflect the vibrations somewhat peculiarly, and conduce to the result. The elements of each of these sounds are mingled in different degrees, and the shades of deviation from the normal are almost infinite.

As there is no absolute and exact standard of normality in distinguishing the sounds, the whole chest must be examined, and the parts suspected of disease must be carefully compared with those supposed to be healthy ; and the normal differences in different locations

must be taken into account. For example, a comparison of the anterior part of the chest on one side, in the infraclavicular region, with the posterior part of the other side in the scapular region, would give the greatest contrast in the percussion sound in healthy lungs. Over the scapula, the vibrations from the lung substance, brought up through so many layers of tissue exterior to it, are to a large extent scattered and lost, and the sound partakes largely of the character of that produced by striking upon a hard substance. The vibrations are chiefly from these coverings—almost entirely so when the blow is gentle. Striking with more force, however, will send down and bring back more vibrations from the lung, manifesting their peculiar character in the sound.

Morbid percussion sounds differ from the healthy chiefly in consequence of deviations from the normal condition of density; and where no change of structure in this respect exists, whatever the disease, no material change will occur in the percussion note. Percussion then is negative—that is, it gives no deviation, no signs of morbid change, in various diseases of the respiratory apparatus. It is in this sense generally *negative* in bronchitis, in asthma, in pleurodynia, in neuralgia, in laryngeal disease, etc. When thus negative, it excludes those diseases which produce consolidation, effusion, or any structural changes diminishing the sonorousness of the lungs. It is therefore valuable in its negative as well as in its positive indications.

A synopsis of the percussion sounds is given in the following scheme, modified from Thompson :

SOUNDS.	SIGNIFICANCE.
Clear or Resonant.....	Healthy lung and vesicular respiration.
Dull and Flat.....	<div style="display: inline-block; vertical-align: middle;"> <div style="font-size: 4em; vertical-align: middle; line-height: 1;">{</div> <div style="display: inline-block; vertical-align: middle;"> <p>Increased density of pulmonary tissue. Morbid deposits in air sacs.</p> <p>Tumors of Lungs. { Enlarged glands. { Malignant growth.</p> <p>Pleural effusions.</p> <p>Aneurisms.</p> <p>Very thick pleura.—Infiltration.</p> </div> </div>
Tympanitic...	<div style="display: inline-block; vertical-align: middle;"> <div style="font-size: 4em; vertical-align: middle; line-height: 1;">{</div> <div style="display: inline-block; vertical-align: middle;"> <p>Resonant. { Contiguity of stomach and intestines. { Pneumothorax.</p> <p>Muffled .. { Much distended stomach.</p> <p> { Much Distended Lung. { Emphysema. { Acute tubercle.</p> <p> { Tense pneumothorax.</p> </div> </div>

Amphoric.....	{ Phthisical cavity with air. Pneumothorax.
Cracked Pot.....	{ Small cavity with elastic walls. Bronchial dilatation with ditto.
Vesiculo-tympanitic.....	{ Pleuritic effusion, sound above. Emphysema, miliary tubercle.

The regional distribution of sounds is a matter of interest, and is often important in aiding in the interpretation of those sounds. Particular diseases have special localities—parts of the lungs in which they are most likely to be situated. There are some general facts which should be noticed.

Diseases arising from stasis in the blood-vessels have a tendency to affect the most dependent part of the lungs.

Pleuritic effusions are situated near the diaphragm, while diseases from irritation of the air passages are likely to affect the apex and the expansile part of the lungs; and it is well known that tubercular deposits are generally first and chiefly in the upper part of the lung.

If on percussion the vesicular resonance belonging to one lung extends beyond the middle of the sternum, it indicates a crippled and contracted condition of the other lung.

Increased resonance in the lower portions of the lungs, when chronic pulmonary symptoms are present, would raise a suspicion of tuberculosis.

Dull percussion, affecting the lower posterior border of the lung, especially the right, suggests congestions, croupous pneumonia, and if flat, pleuritic effusions.

When there is dullness close to the lower angle of the scapula, especially on the right side, it will raise the suspicion of pulmonary apoplexy.

Dullness over the upper lobe in moderate degree suggests congestions, or the earlier stage of phthisis, or hemorrhagic inhalation; if in greater degree, pneumonia, perhaps with tubercle or fibrosis of the lung; over the middle portion of both lungs, if in connection with mitral regurgitations, it would indicate congestion, induration—or what is by some called brown induration.

Empyema generally presents dullness in the lower axillary region of one side. Dullness from enlarged glands, malignant tumors, and aneurism, is in the upper sternal region, or the interscapular region near the spine. A tympanitic percussion note, especially when amphoric in the upper part, indicates a cavity in the lung; in the lower part, air in the pleural sac.

AUSCULTATION.

Auscultation, or the listening to the sounds produced in the chest by the respiratory act, by the voice, etc., is, on the whole, the most valuable method of distinguishing the conditions of the organs of respiration. The actions of many organs of the body, as the liver, the kidneys, and the brain, are carried on noiselessly and give no evidence by sounds of their normal or abnormal states.

This is not the case with the lungs and the heart; and the sounds which occur in health and in disease of these organs are often distinguishable from each other. The observance of the normal and abnormal sounds becomes a means of diagnosis of which no physician can afford to be ignorant.

We apply the ear or stethoscope to the chest to hear the sounds of respiration, of the voice, of the cough, of the heart-beat, of arterial and various other murmurs.

The methods are *immediate*—the application of the ear directly to the chest; and *mediate*—where some instrument is interposed. The instruments made use of in thus listening are called stethoscopes.

Each of the methods, with and without instruments, has its advantages and defects, and both should be practiced; and, as a rule, immediate should be first. In ordinary cases of diseases of the lungs, where the hearing of the observer is acute, the direct application of the ear to the chest is sufficient for practical purposes. Most of the normal and abnormal sounds can be recognized and judged of by the unaided sense. In cavities of the lungs, the stethoscope isolates the sounds better, and some sounds are better distinguished by it; and when the hearing is not acute, the exaggerations of the sounds which a good instrument produces renders them more clearly audible, and with any ear practised to the use of a proper instrument, distinctions can be made which would escape observation without it.

Various stethoscopes are used—Camman's binaural is best for the most exact and most expert work.

In the use of an ordinary wooden stethoscope, the sound is conveyed partly through the air in the opening, and partly through the solid wood.

Friction sounds are readily conveyed through wood, as may be illustrated by scratching upon one end of a long stick of timber while the ear is applied to the other; but sounds are also conveyed to a distance through a tube with little abatement, when prevented from radiating laterally. The ear directly applied to the chest receives the sounds from a larger area of lung than when a stethoscope is used with a small chest-piece; and the latter method locates the sounds

with more precision. When a moderately large trumpet-shaped chest-piece is used, sounds are collected from a considerable area, and by concentration are more intense. In the use of Camman's stethoscope the sound is concentrated, is conveyed through the air directly into the opening of the ear, and is louder and more distinctly heard than by the direct application of the ear, or than by the common stethoscope; but these sounds are often confusing at first, and practice is required to make this instrument most available and useful. Practice, with concentration of the attention, cultivates and improves all the senses, and none more than the sense of hearing. Musical cultivation is an illustration; and the expertness of the piano-tuner in detecting the slightest difference in the pitch of sounds is familiar. This art is obtained by studying the subject, and by careful attention and practice. Such attention and practice are required to make the most successful auscultator.

Certain rules for the proper practice of auscultation must be observed.

In mediate auscultation the stethoscope is best applied to the naked skin. A large part of the chest need not be exposed at the same time, but any covering over the part to which the instrument is applied is in danger of obstructing, or by friction modifying, the sound. In immediate auscultation, a single, thin, soft covering, as of a handkerchief, or a thin unstarched piece of linen or muslin may be allowed; but listening through several thicknesses of clothing destroys all proper distinctions and discriminations, and must be regarded as an evidence of inexactness, if nothing worse. When the only thing to be determined is the presence or absence of loud bronchial sounds, or some voice or cough sounds, the ear may be applied to the chest over some thicknesses of clothing; but when other than these loud sounds are to be listened for, the rule as to covering should be observed.

The chest-piece must be applied evenly and firmly upon the chest, the rim touching at every point, so that all the sound from the part of the lung covered by it will be confined and conducted into the tube, and no sound will be permitted to enter from without. The ear must thus be accommodated to the stethoscope in its proper situation, and the instrument must not be tipped to accommodate it to the ear.

The position both of the patient and the examiner must be easy and unrestrained. Action of the muscles of the chest of the patient will produce a rumbling muscular sound, which may obscure that from the lungs, and the action of other muscles will often cause unsteadiness of position; while the uneasy position of the examiner may

prevent that concentration of attention which is necessary for the most accurate observation.

In auscultation, as in percussion, all parts of the chest must be examined, and comparisons must be made of the sounds heard at different points, and especially must the corresponding points of the two sides be carefully compared.

Care should be taken to exclude extraneous sounds. Not only does clothing obstruct the breath sounds, but when interposed between the ear or stethoscope and the chest, it is apt to produce friction sounds, which may obscure or be mistaken for sounds produced within the chest. All flannel, rough linen or cotton, silk and other rustling materials, must particularly be put aside. It is far better, in making a careful examination, to have all clothing removed from the chest. With ladies, however, a large part of the chest need not be exposed at the same time, but the clothing can be so moved about that the instrument, without any general exposure, can be placed upon the naked chest. Care must be taken that hairs upon the chest, or a rough skin, as from ichthyosis, do not produce a sound under the stethoscope. Rubbing the hand upon the chest, or taking hold of the stethoscope roughly or suddenly may produce a misleading sound.

The confounding of the muscular murmur with pulmonary sounds should be guarded against. The muscular murmur is a more constant rumbling sound, independent of respiratory movement, and is heard much more distinctly in some persons than others. An easy position of the patient will diminish it, but in some it will rumble on in the thickest muscles in whatever position the patient is placed.

In acute cases the examination should be made often, and in chronic ones repeatedly. Often a sound, not noticed at first, may be detected afterward. The ordinary breathing should be listened to first, then the patient should be requested to take a full breath, and, if he hesitates, a full inspiration should be taken by the examiner, which the patient is requested to imitate. If he fails to do so, which is sometimes the case, he should be requested to cough, after which he will instinctively fill his lungs rapidly. These processes may be repeated as required, and the sounds may be observed in each part of the lungs in these different modes of breathing. Listening to the sounds of the voice, and to those produced from the chest while coughing, is also often important. The sounds must be observed over the larynx, trachea, the large bronchi, and especially over the lung substance.

Both the inspiratory and expiratory sounds must be observed, and their properties of intensity, pitch, duration, special quality, and rhythm should be particularly noticed.

There are three kinds of sounds heard over the breathing appa-

tus, depending upon the parts to which the ear or stethoscope is applied. These are tracheal or laryngeal, bronchial, and vesicular. The tracheal sound is heard by placing the stethoscope over the trachea or larynx. The sound is harsh and blowing, as of air rushing through a large rough tube. The quality of the sound is what is called tubular, and as it passes through the expansion of the larynx it gives the idea of a cavity of considerable size, and is called *cavernous*. It is loud in deep breathing, the pitch is rather high, and its duration depends upon the length of the respiratory movements. There are some differences in the inspiratory and expiratory sounds worthy of notice.

The *pitch* of the expiratory sound is somewhat higher than that of the inspiratory, the *intensity* is greater, the *duration* is generally longer, and there is a short interval which separates these sounds.

The *bronchial* sound is a modification of the tracheal, but it is not so intense, not so harsh or so hollow in quality, not so concentrated, and it is seldom heard in the normal state. It is generally presented as a modified or morbid breath sound, and will soon be described as such.

The most important breath sound is that heard over the lung substance, which covers and envelops the bronchial tubes. This, in the normal state, is a breezy, soft, swelling and declining rhythmical sound, corresponding with the movements of the chest. It varies in intensity, being louder in full breathing, and with some persons than with others. It is low in pitch, peculiar in quality, and is chiefly produced by the air passing into the air vesicles, and is therefore said to be vesicular.

The inspiratory sound is much more distinct, and much longer in duration than the expiratory; indeed, the latter is commonly not heard, when listening with the unaided ear, in the quiet unconscious breathing of the male adult when at rest. This breathing sound is called the *normal vesicular respiratory murmur*.

The inspiratory sound is produced, it is thought, particularly by vibrations excited in the inward current of the air, by its striking against the walls of the passages to the pulmonary vesicles, and by the forcible separation of the walls of these vesicles, slightly adherent together as they are by their natural moisture. The mere passage of the air through the minutest tubes into the expanded vesicles may contribute to the sound.

The expiratory sound, it is supposed, is produced simply by vibrations excited by the expired air impinging against the walls of the air passages. It is at any rate more bronchial in character, and has not the peculiar vesicular quality. The expiratory sound begins with a gentle rustle and passes into a puff, which is neither properly

vesicular nor distinctly bronchial in quality. As the inspiratory sound is caused chiefly by the air passing into and expanding the alveoli near the surface of the lungs, modified slightly by the sound of the air passing through the bronchi, and the expiratory sound is chiefly produced by the air passing out through the bronchi ; and as the expiratory movement is ordinarily the result of the elasticity of the lungs and their surroundings, it commences as soon as inspiratory efforts cease, *and the expiratory murmur follows the inspiratory without a perceptible interval.*

The intensity of the respiratory murmur varies much within the limits of health ; and it is more important to study its pitch and quality than its loudness.

The pitch of inspiration is low, and its quality soft and vesicular. That of expiration is higher, and the quality harder and much less vesicular.

The verbal descriptions, though suggesting various distinctions, necessarily fail to give clear conceptions of the respiratory sounds. They must be heard in order to be understood ; and when by practice they are rendered familiar to the ear, the verbal descriptions can be appreciated.

The normal vesicular breath sounds and the murmurs are typical in the infraclavicular, the upper axillary, and the infrascapular regions. The sounds of the two sides sometimes entirely correspond in health, but often fail to do so ; the difference being greater in some persons than in others. On the right side the primary bronchus is larger and somewhat differently situated from that on the left ; and, as a rule, the respiratory murmur on the *left* side is lower in pitch, softer in quality, and more vesicular than upon the right. The expiratory sound is more frequently absent on the left side, and is shorter and less intense when heard. The difference in the two sides, as already intimated, is not great, and is often scarcely perceptible ; but there usually is some difference, and in some persons it is quite marked. Particularly the expiratory sound is often prolonged at the upper part of the right lung without being an evidence of disease.

In children the respiratory murmur is louder than in adults ; but in other properties it is the same. It is also louder in females than in males, especially in the upper part of the chest ; and also in narrow-chested and nervous persons, than in those of broad chests and unimpressible temperaments. It is shorter and harsher in old age than in adult life, and the intensity of the inspiratory sound is often diminished and the expiratory sound is longer and more distinct. This change in the murmur is supposed to be produced by alterations in the walls of the air cells of the aged.

The laryngeal and tracheal sounds, from the air passing through tubes of such large size and roughened walls, are harsh, loud, blowing, and cavernous ; and as the air passes out through these tubes as freely as it passes in, the sound of expiration is quite as loud and long as that of inspiration. Indeed, from the concentration of the currents from the numerous bronchi into one, the expiratory laryngeal is often louder than the inspiratory sound. Different from the vesicular murmur, which in unconscious breathing presents no interval between the inspiratory and expiratory, in the larynx and trachea these sounds are separated by a very perceptible interval. The outward flow from the bronchi must continue some little time before acquiring sufficient force to cause a sound in these larger spaces.

MODIFICATIONS OF BREATH SOUNDS.

Bronchial respiration is the sound produced by vibrations of the air in the bronchial tubes, not necessarily in other than a normal state. It is generally said that these vibrations are caused by the air passing through these tubes, and doubtless the flow of the air through them produces more or less vibrations ; but recent experiments, made by MM. Boudet and Chauveau upon a horse laboring under pneumonia, with consolidation of one lung, seem to show that the sounds which are called bronchial are produced, not in the bronchial tubes themselves, but in the larynx or trachea, and are transmitted along the bronchi in the same manner as sounds are conveyed through a speaking tube. The experiments consisted in opening the trachea, and thus preventing the air from passing through the larynx, when the bronchial sound over the consolidated lung ceased. To render it more positive that the sound heard over the lung was produced in the upper air passages, a reed or whistle was placed in the trachea, and the sharp sound produced there was distinctly and intensely heard when the ear was placed over the consolidated lung.

But whether the sound originates in the upper air passages or in the bronchi, the vibrations causing the sound are transmitted from them to the surface.

As the bronchi are covered with the lung substance, which is from its structure a poor conductor of sound ; and as the vesicular sound—that of the air passing into the air vesicles—is nearer the walls of the chest and the ear, the passage of the air through the healthy bronchi, or the vibrations however produced which are within them, in healthy conditions of the lung substance, generally produce no well-defined or perceptible sound at the surface. Over a primary bronchus, however, especially on the right side, at the second interspace, and near

the sternum, and between the scapulæ, slight bronchial sounds are often distinguished mingled with the vesicular murmur : at least the vesicular sound is sometimes perceptibly modified by the bronchial in this situation. When a portion of lung is consolidated that covers the bronchi, the vesicular murmur is diminished or lost, and the solidified lung is made a better conductor of sound ; and the air now passing through the bronchi, or the sound within them, is heard when the ear or stethoscope is applied to the chest. This constitutes the characteristic *Bronchial Respiration*, the most important of the modifications of breath sounds for the diagnosis of disease, and which therefore requires careful study. Bronchial respiration resembles tracheal. It is blowing instead of breezy—it gives the idea of air passing through tubes instead of into air cells ; but it is simpler and less hollow or cavernous than tracheal or laryngeal—gives the idea of air passing through several smaller tubes rather than one large one, and does not suggest its passing in and out of a cavity.

It is to be particularly distinguished from the normal vesicular respiratory murmur, as it is heard in situations where that is usually heard, and its being thus heard is indicative of a change in the structure and conducting quality of the lung covering the bronchi, and of a change in the capacity of the lung for receiving air into the alveoli.

Compared with the normal lung sound, the following differences appear :

NORMAL VESICULAR RESPIRATION

Inspiration.

Low in pitch, vesicular in quality, soft, breezy, and gentle.

Expiration.

Much shorter, less intense, and when heard, continuous with inspiration.

BRONCHIAL RESPIRATION.

Inspiration.

High in pitch, tubular in quality—hard, dry, and rough, and much more intense, as if blown into the ear.

Expiration.

As long or longer than inspiration, more intense, and separated from inspiration by a perceptible interval.

Bronchial respiration, then, when heard in the place of the normal vesicular respiration, is an evidence of solidification of the lung, of its impairment by disease.

There are different degrees in the character of this sound, as the solidification causing it is more or less complete.

When the solidification is partial, and some of the air vesicles in

the part are open and receive the air, there is a mingling of the sounds—a modification but not complete perversion of the normal sound. This is called broncho-vesicular respiration, harsh or rude respiration, or prolonged expiration. It is higher pitched, more blowing, is tubular, breezy, and rougher than the soft breezy respiration of healthy lungs, and the expiratory sound is much more distinctly heard and is prolonged. This kind of respiration is oftenest heard in the early stages of tuberculosis, when the lung is partially solidified by deposits, but where many air vesicles are still open and performing their function. It is heard, however, wherever the lung is made a better conductor by increase of its connective tissue, or any of its solid parts, even when its air cells are not all filled up or obliterated. When the air cells of a part of the lung are all filled by a solid exudate, as in the complete hepatization of croupous pneumonia, perfect bronchial respiration is then heard.

Cavernous respiration is a modification of the blowing respiration. As its name implies, it suggests an enlarged space in the lungs, and is commonly regarded as being produced by the air passing in and out of a cavity, or through a dilated bronchus, generally with solidification of lung above. It may, however, be caused, in part at least, by the transmission of the sounds from the larynx, as in the case of bronchial respiration. Compared with simple bronchial respiration, the cavernous is lower in pitch, and more hollow in quality, more simply blowing and less tubular, and is almost identical in some cases with the sound heard over the larynx in respiration. It is heard both in inspiration and expiration, and the expiratory sound is still lower in pitch than the inspiratory. In order to the production of this sound in a cavity, except as it is conveyed down from the larynx, the cavity must be of considerable size, must be empty, or partially so, must not be very far from the surface of the lung, must have expansible walls so as to have its size increased, and thus to admit more air when the chest is expanded in inspiration, and to allow of its expulsion again in expiration; and it must always communicate with a bronchus. It is possible, however, that without this expansibility the sound from the larynx and trachea may be conducted down a bronchus, so as to be heard in a cavity near the surface of the chest, with solidified tissue between it and the chest walls. These conditions are not always present in pulmonary cavities, and the absence of cavernous respiration does not prove that no cavity exists.

The term *amphoric respiration* is applied where a sound is heard like that produced by blowing gently in or across the mouth of an

empty bottle. It is slightly ringing and musical, and is heard where the air passes through a comparatively small opening into a space with smooth walls—a condition of things not often occurring in pulmonary cavities, and it is consequently seldom heard in these; but such conditions are usually present in pneumothorax, where there is an opening through the lung and pleura into the cavity of the chest, into which the air rushes in the expansion of inspiration, and passes out again in the contraction of expiration; and amphoric respiration is often heard in this affection.

The vesicular respiratory murmur may be changed in *loudness* without any other material alterations. It is generally increased—becomes more intense—in a well part of the lung when obstruction exists in another part. When thus exaggerated, but in other respects normal, produced in healthy lung tissue, it is called *puerile respiration*, from its resemblance to the more intense respiration of the healthy child.

It accompanies disease as a shadow does a substance, but is no part of it. It is compensatory, and is an evidence of health in the part where it is heard, but of disease in some other part.

Contrary to what occurs in the last-mentioned case, the respiratory murmur is *diminished* in loudness, and often in duration, in various conditions, without being otherwise changed.

It is thus diminished in intensity in partial obstruction of the air tubes of a part or of the whole of the lungs, by whatever means; by a thin layer of pleuritic effusion, or a layer of plastic pleuritic exudate. It is also diminished in feeble respiratory movements; in very fat persons where the layer of fat in the external walls of the chest interferes with the transmission of the sounds; and in any case where the proper expansion of the air cells is interfered with. The respiratory sound is often diminished at particular points in the early stage of tuberculosis.

The respiratory murmur may be *suppressed*—entirely lost—by a sufficient increase of the causes diminishing it. Thus a complete, or nearly complete, obstruction of a bronchus will suppress the respiratory sound in the part supplied by that bronchus. Large pleuritic effusion removing the lung from its normal position in the chest; complete consolidation of a part including the bronchial tubes; the presence of a large tumor replacing the lung tissue; the presence of an abscess, etc., will produce silence in the part affected.

Alterations in the *rhythm* and *time* of sounds not unfrequently occur. The inspiratory sound, like the inspiratory movement, visible or palpable, is often shortened in dyspnoea. It is sometimes deferred—that is, the inspiratory act begins and continues some time

before the air audibly passes into the air vesicles. This occurs particularly in emphysema and in other conditions of unusual expansion of the lungs.

The expiratory sound is usually prolonged in emphysema and asthma; and the regular, smooth, continuous sound is interrupted in some conditions. We have hitching, cog-wheel respiration sounds, as well as cog-wheel movements of the chest. Irregular expansion of the walls of the chest, or the substance of the lungs, and consequent irregularity of the flow of the air, from whatever cause, will produce irregularity of the respiratory sound; but the most frequent cause of such irregularity of sound is the influence of the heart impulse striking against the lung tissue; it communicates its force beyond its immediate surroundings, and interrupts the continuous, regular inflow of the air.

A synopsis of the changes in the respiratory murmur is presented in the following tabular form.

There are changes in the breath sounds in

Intensity,	<ol style="list-style-type: none"> 1. Exaggerated—puerile respiration. 2. Diminished respiration. 3. Lost, suppressed, or absent respiration.
Quality, and	<ol style="list-style-type: none"> 1. Broncho-vesicular or rude respiration. 2. Bronchial respiration. 3. Cavernous respiration. 4. Amphoric respiration.
Rhythm or time of per- formance.	<ol style="list-style-type: none"> 1. Interrupted—cog-wheel respiration. 2. Divided—perceptible period between inspiration and expiration. 3. Shortened inspiration. 4. Deferred inspiration. 5. Prolonged expiration. 6. Prolongation of both inspiration and expiration. 7. Shortening of both inspiration and expiration. <p>Panting respiration.</p>

All the foregoing are modifications of normal sounds, or natural sounds heard in unusual places. They are all of them interesting philosophically and important practically, as indicating pathological conditions, and require to be carefully studied, distinctly recognized, and properly appreciated.

ADVENTITIOUS BREATH SOUNDS.

Another class of breath sounds are produced by certain diseased conditions, differing from those already mentioned in being new sounds, more distinct in character, and not mere modifications or misplacements of natural sounds. Different terms are used by different authors, some refining more and others less, and it is not easy to convey in words the ideas obtained by a large experience. All these sounds are by most called rattles, râles, or rhonchi, all meaning the same thing, while others apply the several terms to particular adventitious sounds.

The adventitious sounds are produced, some in the air passages, some in the alveoli, some in cavities in the lungs, and some in the pleural sac. These new sounds may obscure the natural sounds or take their places; or they may be heard in connection with them. They have widely different characters and causes, and may be classified, though imperfectly, as follows:

Râles.	{	Dry	{ Sonorous. Sibilant.	} Produced in bronchi.
		Moist.	{ Mucous.. { Large. { Small.	
			{ Subcrepitant.	
		Hollow Gurgles	{ Large. { Small.	} Produced in cavities.
		Crepitant..	{ Fine crepitant. { Dry primary. { Moist redux.	
		Crackling..	{ Dry. { Moist. Occasional click.	} Produced in pleura.
		Friction...	{ Grazing. Rubbing. { Grating. Squeaking.	
		Metallic tinkling.		

Dr. R. E. Thompson, of the Brompton Hospital for Consumptives, London, uses the term *râle* in a very restricted sense, as the rattle of bubbles bursting—the moist bronchial râles in the above classification.

Crepitation he defines a fine, dry crackle; Rhonchus, a snoring sound; Sibilus, a whistle of varied pitch; and Gurgle, a hollow, gurgling rattle. The adventitious *vesicular* sounds he divides into four classes, viz.: Fine Crepitation, Crepitant Râle, Subcrepitant Râle, and Bubbling Râle. The first is dry; and the others are more

or less fine, but moist. The same sounds are recognized by others, but somewhat different terms are applied. A knowledge of the different manner in which terms are used may obviate the appearance of discrepancies when different authors are read.

An important distinction is the division into dry and moist sounds—the moist are bubbling and suggest a fluid; while the dry do not, and are often vibrating and musical. This distinction is particularly made in the bronchial râles. The *dry* are produced in the tubes by narrowing of their calibre in points, either by swelling—growths or deposits in their walls—by spasms of their muscles, by pressure upon them from without, by stricture from cicatricial contraction, by mucus adhering to their internal surface, or by foreign substances lodged within them. In character they are vibrating, whistling, musical sounds. The higher pitched, called *sibilant*, are usually produced in the smaller tubes; while the lower pitched are called *sonorous*, and are produced in larger ones. These sounds are entirely different in cause and character from those of bronchial respiration—the latter being produced in healthy and unobstructed tubes, heard because of the condensation and better conducting quality of the lung over them, while the others are produced by obstruction in the tubes as just described. These râles are heard most frequently in bronchitis, asthma, and emphysema. In bronchitis the irregular swelling of the tubes at different points, or the adhesion of tenacious exudate in some situations, often produces narrow openings through which the air presses into larger spaces, producing the mechanical conditions which cause whistling sounds. Their loudness depends upon the force with which the air passes, and their pitch, upon the size of the tube. In asthma the irregular spasmodic contraction of the tubes, at some points more than others, produces the same essential physical condition and the same audible results; and in emphysema the pressure of distended air vesicles at particular points upon the tubes from without, produces the same effects. Dilatation of small tubes in points may possibly also produce these musical sounds.

The *moist* bronchial râles, called mucous râles, are produced by air passing through fluid in the tubes sufficiently thin to cause bubbling. This condition often exists in bronchitis, where the exudation of thin mucus and mucopurulent fluid is so common. In this affection, both in the acute and chronic form, the conditions are often combined, producing both dry and moist râles at the same time, the moist as well as the dry being low or high pitched, large or small, according to the size of the tube in which they are produced. In pulmonary hemorrhage, pulmonary œdema, the suppurative stages of pneumonia and phthisis, and whenever fluid is in the tubes, from

whatever cause, moist bronchial râles are likely to occur. In all these cases, both the dry and moist bronchial râles are fugacious. Caused mostly by the presence of fluid or tenacious matters frequently changing their position, or by spasms frequently relaxing, they are often interrupted; and, even when the obstruction is more permanent, the more or less forcible respiration produces changes, all of which cause the sounds to be irregular in their occurrence. A fit of coughing and expectoration will almost always change materially the location and character of the sounds, or remove them entirely for a time.

The *subcrepitant râle* is a moist, fine, bubbling sound, produced by the air passing through fluid in the *capillary* bronchial tubes. It is heard chiefly in capillary bronchitis; as then the swelling of those minute tubes and the exudate within them causes the air to pass through into the alveoli and back with difficulty, producing a fine, bubbling or rattling sound both in inspiration and expiration. This is heard most purely at the extremities of the lungs, when the capillary bronchial tubes are inflamed, but where the inflammation does not reach the air vesicles, and where large tubes are not present to furnish other sounds. When the inflammation reaches the vesicles, and bronchopneumonia is present, there is a mingling of the subcrepitant with the crepitant râles; and generally there are more or less of the coarser or ordinary bronchial râles, dry or moist, occurring at the same time over most parts of the lungs. Usually, when the capillary tubes are inflamed, the larger bronchi are affected also, presenting their physical evidences, whether the alveoli and the lung substance are involved or not.

The subcrepitant râle is also heard in pulmonary œdema, and may be heard at other times, as in the breaking-up stage of croupous pneumonia, or whenever a free quantity of fluid passes through the minute bronchi on its way from the alveoli.

The *crepitant râle*, or, as it is often called, fine dry crackle, is interesting and important, and as it is pathognomonic of a frequent and severe disease, is worthy of very careful study. It is a very fine, snapping or crackling sound, which has been compared to the sound produced by forcibly rubbing between the fingers a lock of hair near the ear, or by holding near the ear the mouth of a vial in which a glutinous fluid, as a mixture of the white of egg and water, has been shaken, forming numerous bubbles which burst in rapid succession, producing numerous fine explosive sounds. It has also been compared to the sound produced by throwing salt into the fire; but nothing represents it better than pressing the ear against a new curled-hair pillow or cushion. Different explanations have been given of the mechanism of the production of

this sound, but the conditions in which it occurs are those where the air vesicles are partly filled with exudate into which the air passes in inspiration. It is heard in the stage of inflammatory engorgement of pneumonia, when exudation has taken place into the alveoli, but before they are completely filled, constituting hepatization. When the vesicles are completely filled, and hepatization has occurred, the air no longer enters them, and this râle ceases and is replaced by bronchial respiration. When, however, the solid exudate in the vesicles softens, is partly absorbed or partly discharged, the air again enters, and the crepitation returns. It is now somewhat modified—moister and coarser in character—and is called *redux* crepitation, or by Thompson, crepitant râle, as distinguished from fine, dry crepitation. The snapping sound is probably produced by the air vesicles agglutinated together during expiration suddenly separating their walls in inspiration; or it may be by the sudden bursting of the air through the partially obstructed minute bronchi and infundibuli into the alveoli; or possibly in both these ways. This sound is only heard in inspiration, is generally easily recognized, and is quite characteristic of the early stage of pneumonia.

In this early stage of croupous pneumonia, when the exudate is plastic and tenacious, the crepitation is dry and high pitched. In catarrhal pneumonia, as well as in the breaking-up stage after hepatization in croupous, when the crepitation replaces the bronchial respiration, the râle is lower pitched and more moist or bubbling—often shading off into the subcrepitant sound, or being mingled with it. It is distinguished from the subcrepitant in being heard only in inspiration, while the latter is heard both in inspiration and expiration; and in the early stage of pneumonia, when it is more characteristic, it is distinguished by its dry character, and its sharp, high pitch.

Gurgling sounds, or sounds resembling those produced by taking water into the throat, throwing the head back and breathing through it, are produced by air passing through fluid causing bubbling or agitation in cavities. These sounds may be produced in vomicæ in the lungs, in dilated bronchi, or in the trachea or larynx. In large cavities the sounds are larger or coarser, while the reverse is the case in small ones. The bronchial opening in a pulmonary cavity must be upon a line with or below the surface of the fluid within it; and the cavity must be expansible so that the air will enter on inspiration and pass out in expiration, conditions not always present when cavities containing fluid exist; and therefore the absence of these sounds does not disprove the existence of a cavity; but when these hollow bubbling sounds are heard in the chest, they are proofs of cavities, or of dilated bronchi. When the cavity is near the wall of the chest, or when only

consolidated lung intervenes, the sound is loud and striking; while under other conditions it will be more faint.

Crackling sounds, dry or moist (two or three crackles during an inspiration or expiration), are heard in some cases of tubercular disease; but the method, or even place of their production, has not been positively determined. They are indicative of the softening of tubercles—are dry as the softening begins to occur, and moist after its more complete occurrence. These sounds, however, are so frequently absent during the progress of tuberculosis, that their absence cannot be regarded as evidence against the existence of this disease.

Pleuritic friction sounds are produced by the rubbing of the pleural surfaces together, when roughened by an inflammatory condition, or by the plastic exudates which are often poured out. They are of a slight grazing character when they occur in the very early stage of pleurisy, are suppressed as serous effusions are poured out; but at a later stage, when absorption of the fluid has taken place, and more roughened surfaces are brought in contact, or when false membrane is formed, but firm adhesions have not been organized, a rougher, grating, rumbling, or squeaking sound will often be heard. The sounds are superficial, and are sometimes so loud as to be noticed by the patient, or heard without the ear being applied to the chest.

Metallic tinkling is a sound seldom heard, and when it is, it indicates conditions which are more certainly distinguished by other signs. It is described as a sound resembling that heard when a pin is in a fresh, tensely distended bladder which is violently shaken. It is produced by a fluid dropping down in a cavity of considerable size and with smooth walls. It is chiefly heard in cases of pneumohydrothorax, and in some large cavities in the lungs.

AUSCULTATION OF THE VOICE.

The normal vocal resonance is the sound, not modified by disease, coming from the chest when the ear is applied during speaking. It is a distinct, diffused reverberation, produced by the same cause as the vocal fremitus. It is produced by the same vibrations, but discovered by the sense of hearing rather than the touch. It may be heard on application of the ear to any part of the chest, but is heard more distinctly over the larger bronchial tubes, and usually most on the right side. It is heard more in the pronunciation of some words than others, and is always louder in a deep, low-pitched voice.

In diseased conditions the vocal resonance may be changed in various ways. These changes may be arranged in the following tabular form :

- | | |
|----------------------------|---|
| 1. Diminished. | { Weaker than normal.
Not audible—or absent. |
| 2. Increased and modified. | { Exaggerated simply.
Bronchophonous.
Pectoriloquous.
Egophonous.
Amphoric. |

The voice sounds from the chest are weakened, without other material change, in bronchitis with free effusion in the tubes which obstructs the vibrations of the air through them; in plastic pleurisy; in extreme consolidation of the lungs including the bronchi; and in other conditions that diminish vocal fremitus.

The vocal resonance is simply exaggerated, without being otherwise changed, in slight increase of density of the lung, and when the voice is made lower in pitch, as by a common cold in the throat. It is inaudible in the part of the chest where there are free effusions or other conditions which entirely prevent vocal fremitus.

Bronchophony is a more intense, concentrated voice sound coming from the chest, high pitched and thrilling, sounding as if spoken, but with some indistinctness, into the ear, and is produced by *condensation* of the lung, and by its thus becoming a better conductor of sound; and its degree varies according to the degree of condensation. It occurs from the same causes which produce the sounds of bronchial respiration, and is coincident with it.

Pectoriloquy is a further modification of the voice sounds, and literally means *speaking* from the chest. Not only the voice sounds come forcibly from the chest, as is the case in bronchophony, but the speech—the articulation of words clearly distinguishable—is heard from the same source. Even the words whispered are often distinctly recognized, and it is then designated as whispering pectoriloquy.

These pectoriloquous voice sounds are heard chiefly over cavities in the lungs or over largely dilated bronchi; but sometimes they are heard over the larger bronchial tubes covered by a highly condensed stratum of lung. Whispering pectoriloquy was formerly considered as certainly indicative of a cavity, but it has been heard where only an extreme condensation of lung has been found over bronchial tubes. In order that pectoriloquy should be heard over cavities, the same conditions must exist as cause cavernous respiration.

Egophony, or the goat cry, is a tremulous voice sound heard sometimes through a thin layer of fluid in the chest, or from the chests of old persons with condensed lungs.

Amphoric voice resonance is like the sound produced by speaking into the mouth of a large pitcher. It is reverberating and somewhat musical, and is sometimes heard over large cavities—more characteristically, however, in pneumohydrothorax; and this sound requires similar conditions for its production as for that of amphoric respiration. The two are usually coincident.

The sounds of the voice, as heard in the ordinary way, have a diagnostic value, especially in diseases of the larynx. Laryngeal inflammation, however slight, and even congestion of its mucous membrane, changes the voice more or less, rendering it either rough and hoarse, or feeble and husky. Acute inflammation of the larynx of any considerable severity generally reduces the voice to a whisper.

When there is difficulty of speaking or phonation, it is called *dysphonia*; and when there is loss or absence of phonation, it is called *aphonia*. Chronic laryngitis and other lesions within the larynx—thickening, morbid growths or ulcerations—almost always affect the voice more or less, changing its character or suppressing its tones. If the voice is quite natural, these affections may be excluded. The glottis and epiglottis being above the vocal cords, may be œdematous, or may be moderately affected in other ways without any material change in the voice. The cry of the child, and the sound of the cough, are affected in a similar manner as the voice of the speaking person.

But aphonia may arise from paralysis of the muscles concerned in the production of the voice, and this may depend upon disease of the nerves or nerve-centres, independent of any structural lesion of the immediate parts.

Again, a feebleness or even loss of the voice may arise from disease of the lungs or the muscles of expiration, in which the air is not expelled with sufficient force to produce phonation. The feebleness of the voice is not, however, an accurate measure of the general feebleness of the patient, or the amount of disease of the lungs; as the voice is sometimes clear and has considerable force when the lungs are extensively disorganized in phthisis; while in other cases it is feeble with much less disease. Disease of the lungs, however, has generally an influence upon the voice, and its sounds are of some diagnostic value.

Aphonia is to be distinguished from *aphasia*, the latter being a defect, not in the vocal organs but in the power of commanding words or forming speech. The one is a loss of voice, the other a loss of speech. Both of these should be distinguished from the mutism of congenital deafness, and from those original mental defects which deprive some persons of the faculty of language. The latter, however, is a form of aphasia, but is not a subject of medical or surgical treatment.

In the preceding account of the subject of physical diagnosis in diseases of the respiratory organs, an attempt only has been made to present its main and most essential features, and to intimate the principles upon which it is founded.

Should the student or the practitioner wish to pursue the subject into more minute details, he is referred to some one of the various special works on the subject; but a complete mastery and full comprehension of the foregoing statements, with proper practical observations, first on healthy persons of different ages, sexes, structures, and temperaments, and then upon those affected with diseases of the chest, will enable the close and systematic observer to become expert in these physical explorations.

GENERAL VITAL SYMPTOMS OF RESPIRATORY DISEASES.

However important in diagnosis the physical signs may properly be considered, the functional changes or rational symptoms are no less so, and are often of even much more importance as indications for treatment. It should ever be borne in mind that the ultimate object of medical science and art is the treatment of patients and the removal of their diseases. Distinguishing diseases is subordinate to this great object, and is practically useful only as it leads to its more safe, more scientific, and more successful accomplishment.

The chief particular symptoms or functional phenomena which belong to the diseases of the respiratory apparatus are *dyspnœa*, *cough*, *expectoration*, *tenderness*, and *pain* in the chest.

A peculiar sensibility of the system gives a desire to breathe. This doubtless has its origin in the tissues generally when not sufficiently supplied with oxygen, but it is particularly expressed in the organs which perform respiration; and this feeling is so powerful, and the instinct depending upon it is so intense, that the reflex respiratory movements go on in sleep and unconsciousness, and can only be restrained temporarily by the will. Voluntary efforts modify, but cannot long prevent respiration. This feeling of the want of breath is called *dyspnœa*, and is often, though not always, accompanied by mechanical difficulties in accomplishing the respiratory act. Occasionally the feeling is experienced when the air is received into the lungs even in unusual quantities, because there is not sufficient blood, or because it is not in a proper state, or so freely circulated as to supply sufficient oxygen to the tissues.

When the feeling of dyspnœa is extreme, it becomes a *sense of suffocation*.

When dyspnœa arises from disease of the lungs or their append-

ages, there is difficulty in obtaining sufficient air, and the breathing is embarrassed and laborious. Even when dyspnoea is dependent upon other causes, the breathing is excited, rapid, and labored. The particular causes of dyspnoea dependent upon abnormalities of the respiratory organs are obstructions in the movements of the muscles of respiration; obstruction to the entrance of air through the mouth and nose, or through the larynx, trachea, or bronchi; or obstruction in the lung substance by consolidation, oedema, congestion, purulent infiltration, pressure upon the lung substance by effusions in the pleural cavity, by tumors, distention of abdomen, etc.

When dyspnoea is present from any structural cause, it is aggravated by exercise (as much more blood circulates then and needs to be oxygenated), by a full stomach, and by certain positions of the body.

In dyspnoea, speaking is frequently arrested to "fetch a breath"; the patient cannot "hold the breath" long, and the frequency of breathing is increased. The normal frequency in an adult is from eighteen to twenty times in a minute, but it is varied by lying, sitting, standing, and walking; and still more by very active muscular exercise. It is slowest in the condition of greatest repose. Not only exertion, but strong emotion often increases greatly the frequency.

Dyspnoea may occur from other causes than diseases of the lungs or appendages, as has already been stated. It may be caused by anæmia, by debility, and especially by diseases of the heart; and the symptom must be considered in connection with other conditions, in determining its diagnostic significance. The ratio of breathing and pulsation, and its changes in disease of the lungs has already been spoken of. The proportionate frequency of breathing is increased, as a rule, when the lungs are affected and dyspnoea exists.

When dyspnoea is marked, there is a presumption of lung disease, which is only to be removed by excluding it by a careful examination, and by finding other causes to account for the phenomenon.

Cough is another symptom indicative of disease of the respiratory system. It is a forcible expiration with an explosive sound, mostly involuntary, but partially under the control of the will; and when not an entirely voluntary act, is caused by reflex action from some irritating impression, usually upon the air passages or lung substance. It tends to remove irritating objects, and with reference to this it has its uses.

When accumulations of secretions occur in the bronchial tubes and the cough ceases, the danger from suffocation is increased. Cough may arise from irritation in more distant parts (acting by sympathy), as in the stomach, the pelvic organs, etc.; or it may be

caused by irritation at the origin or in the course of the respiratory nerves; or by obstructed circulation through the heart, though this latter usually produces cough by causing congestion of the lungs.

There are various kinds of cough, each having its significance. The indications of each variety will be referred to, in connection with the diseased states in which they occur. Their names indicate something of their character. A cough may be dry, hacking, hoarse, moist, stuffy, loose, ringing, hollow, barking, paroxysmal, convulsive, suffocating, affected, nervous, etc. When sputa occur they are usually brought up by the cough, though sometimes merely by the movements of cilia on the mucous surface. A cough not resulting in expectoration has been called an "unavailing" cough.

As an object of treatment a cough is to be directly abated, when it is more than is required to remove irritating accumulations, and when it is a source of irritation, or destroys necessary rest, or produces distress.

An unavailing cough, one produced by a morbid process in the organs rather than by the presence of materials to be removed from them, sometimes aggravates the pulmonary disease and calls for relief. A cough is sometimes accompanied with vomiting or hemorrhage, or prolapsus of the rectum or uterus, when the importance of its abatement is increased.

A cough is sometimes independent of any disease of the respiratory apparatus. Some coughs, artificial or affected at first, may become habitual and automatic, expressive of certain mental states; and in hysterical patients may be severe and distressing, without being at all dangerous. In some cases coughs have been sympathetically or imitatively contagious. A girls' school is said to have been broken up by an imitative cough that prevailed so generally among the pupils, as to entirely interrupt the proceedings of the school. (Cohen's Diseases of the Throat.)

The *sputa*, or the matters expectorated, often furnish important indications as to the nature of respiratory diseases. Indeed, the act of expectoration, and the manner of its accomplishment, has a diagnostic value. The expectoration of blood, pure or nearly so, and in any considerable quantity, constitutes hæmoptysis. The character, significance, and management of this symptom or affection will hereafter be considered.

Blood may be mingled with other expectorated materials, intimately mixed, as in pneumonia, or in streaks, as in some cases of bronchitis, without being regarded as specially hæmorrhagic—certainly not as hæmoptysis; and no efforts are required for its suppression. In these cases, however, it is diagnostic.

An intimate mixture of blood, in a jelly-like material, is sometimes expectorated in cancer of the lungs, and a somewhat similar material is occasionally raised in syphilitic gummata of these organs.

The most common varieties of sputa presenting the grosser appearances are mucous, purulent, and muco-purulent. Mucous sputa are more or less transparent, viscid, often stringy, and when remaining long in the passages may become comparatively dry and hard. They are generally aerated—containing bubbles of air—which render them specifically light, so that they float upon water. Purulent expectorations are generally yellow, though sometimes whitish or greenish, are more diffuent and less adhesive, and are raised more freely; and, being generally destitute of air bubbles, sink in water. Muco-purulent sputa are variable in color and consistency, according to the comparative amount of each of the ingredients which they contain. They are generally yellowish, or yellowish green, and more or less tenacious. When rounded and flattened, assuming something of the form of pieces of money, they are said to be nummular, and often present that appearance in cases of phthisis.

A serous expectoration sometimes occurs. This is a thin liquid, more or less abundant, transparent, and devoid of the appearances given by either mucus or pus. There are, however, mixtures—muco-serous, and sero-purulent; and when the expectoration is abundant and mostly serous, it is called bronchorrhœa. These and other forms of expectoration have their significance, which will be referred to in connection with the diseases in which they occur.

Microscopically examined, sputum or expectorated material is found to consist of—1, young or aborted epithelial cells—mucous corpuscles—mingled with mucin and serous fluid; 2, mature epithelial cells—pavement, cylindrical, ciliated; 3, cells containing granules, or cell-like bodies made up of granules, and free granules; 4, pus cells; 5, blood corpuscles; 6, fibrinous matter, or common inflammatory exudates of a plastic character—presenting in gross appearance flakes or casts of tubes and air cells; 7, fat in granules and globules; 8, tubercle matters—corpuscles, small deformed cells, giant cells, granular matters—earthy, crystalline, and amorphous substances; 9, carbon and true pigment, free or in cells; 10, fragments of pulmonary tissue—air cells, small bronchial tubes, blood-vessels, lymphatics, connective tissue and organized inflammatory products and shreds of false membrane; 11, various foreign substances—particles of dust inhaled, or of foods or other substances taken into the mouth; and rarely parasites are found. In an examination, unless this last class of materials is remembered, confusion or error might follow.

The *chemical* characters of the sputa are often important to be

known. Butyric and acetic acids are sometimes found in the offensive sputa of bronchitis. Chloride of sodium and phosphate of potash are commonly in bronchitic and pneumonic sputa.

Chemical tests may be applied to determine the character of sputa as to pus or mucus and other qualities ; and reagents and the microscope may often be used with great advantage in diagnosis here, as in so many other cases. While these minute appearances are observed, the freedom or difficulty of expectoration—whether painful or easy, abundant or scanty—and the form, color, tenacity, and all other properties must be noticed.

Pain in the parts as an evidence of disease of the respiratory system is to be noticed. Some of these diseases are not attended by pain. Capillary bronchitis, asthma, emphysema, hydrothorax, œdema of the lungs, some cases of tuberculosis, and other diseases are nearly or quite free from painful feelings. Acute pleurisy and pneumonia are usually accompanied with pain ; and in the case of pleurisy particularly it is often acute and severe ; though in exceptional cases, even pleurisy may run its course in a latent form with no remembered pain.

But sharp, lancinating, unilateral pain, resembling that which occurs in pleuritis, may be neuralgic, and situated in the walls of the chest, when the pleura and the lungs are quite free from disease.

Pain, but of a moderate character, commonly accompanies the early stage of acute bronchitis, but it is behind the sternum or upon both sides, and not unilateral as in pleurisy and pneumonia. It is not unfrequently absent, though a sense of soreness on coughing is more constant.

Reflex and radiating pains in the chest are not uncommon, and not unfrequently alarm patients with impressions of severe disease of the lungs, when the source of the pain is in the stomach, uterus, ovaries, or other abdominal or pelvic organs, or in the spinal cord or brain, while the lungs are in no state of structural disease. Still, when there is pain in the region of the lungs these organs should receive attention, and should be regarded as free from disease only after a careful examination of the case has excluded such a supposition. When deep tenderness exists in connection with pain, the indications of local disease are very strong and will not often be set aside.

Pain should be observed as to its exact locality, the direction of its radiations, its severity and its kinds ; and the effect of posture, breathing, laughing, coughing, pressure, etc., upon it should be carefully noticed.

The *posture* the patient assumes ; his decubitus in bed ; the expression of his countenance ; a flushed or pale condition ; the general

physiognomy ; the color of the general surface as indicating the amount of oxygenation of the blood, and the condition of the capillary circulation, are all to be observed. Each form of disease has its own expression in these respects, which may be suggested in books, but must be made familiar by observation and experience.

Mental conditions must also be taken into the account—particularly emotional states, such as anxiety, cheerfulness, hope, despondency, irritability, etc.

The conditions of the skin, its moisture or dryness, its looseness or firmness, softness or hardness, have their indications, which will be from time to time alluded to.

The conditions of the *pulse* may be regarded either as physical signs or rational symptoms. They show, however, the amount and character of certain vital activities ; have always been regarded as important in distinguishing the state of health or disease ; and are as indicative of the conditions present in diseases of the lungs as of any other organ.

The time-honored method of examining the pulse by the application of the fingers to the arteries, particularly the radial artery at the wrist, has not been superseded as a practical measure at the bedside by the sphygmograph, which has of late years come into use. Many important physiological and pathological facts, however, have been determined by this instrument, and its future uses in connection with other mechanical contrivances may be made still more available ; but the ordinary practitioner will continue to “feel the pulse,” as his chief method of learning the condition of the circulation ; and its states in diseases of the lungs should be particularly observed. Its variations in force, in fullness, in frequency, in quickness, and in regularity, not only give evidence of morbid conditions, but of the general state of the system ; and the vigor of vital activity, its power of endurance, and its conditions are even more important as guides to the use of therapeutical measures than as means of diagnosis. The principal characteristics of the pulse and its general indications have been pointed out in another part of this work ; and an account of its particular characters in different diseases of the lungs will be better understood in connection with a description of these diseases.

The *temperature* in diseases of the respiratory system, as of most other diseases, is a matter of great importance ; and the thermometer, as a means of ascertaining it with precision, supplies a most important guide to diagnosis and treatment. Observation of the temperature determines the presence or absence of inflammation, and often its severity, character, and stages. It aids very essentially in determining the presence, or at least the formation and growth of tubercles,

and helps to form a judgment of the occurrence of suppuration, effusions, and other processes of disease. It is the guide in the use of antipyretic remedies, those means which of late have been found so useful in the treatment of febrile and inflammatory conditions. No physician can now do without a thermometer, or without its frequent use in the diagnosis and treatment of pulmonary diseases. It will of course be referred to in treating of the particular diseases of this system.

The digestion, the appetite, the wasting, the debility, the sleep; the conditions of the excretions, particularly of the urine, and the states and functions of the other organs; in short, every condition of the patient—his former diseases, his hereditary tendencies, his occupation, domestic state and hygienic influences, must all be carefully inquired into and observed, in the many phases of this important class of diseases.

The rational symptoms should be examined as though there were no physical signs: and the physical signs as though there were no rational symptoms.

The various diagnostic signs which have been thus sketched will be reviewed, and their particular signification shown in connection with the discussion of the special respiratory diseases which is to follow.

THE PATHOLOGY, DIAGNOSIS, AND TREATMENT OF THE PARTICULAR DISEASES OF THE RESPIRATORY SYSTEM; OR DISEASES OF THE LUNGS AND THEIR APPENDAGES.

NASAL CATARRH.

By this is meant a catarrhal inflammation of the nasal mucous membrane. It differs in degree more than in essential character from what has been already described as a “common cold.” It is, moreover, a decided inflammation of the mucous membrane of the nasal passages, and, like other inflammations, it may be either *acute* or *chronic*, or may occupy an intermediate position between the more decided extremes.

Phenomena.—*Acute Simple Nasal Catarrh* is often a mild affection, and in its lighter forms has been spoken of as a part of the phenomena of a common cold. It is especially mild when the disease is confined to the Schneiderian membrane; but in its severer forms it is apt to extend down the air passages and to the frontal sinuses, and may then entail more decided suffering.

It usually commences by irritation of the nostrils, often by sneez-

ing; the membrane is at first dry and swollen; soon the dryness gives way to a watery secretion, and at length to the secretion of mucus, and in some cases muco-pus; the swelling of the membrane continues more or less, and interferes with the passage of air through the nostrils, and often necessitates breathing through the mouth.

The attack is generally ushered in by some feelings of chilliness, by a sense of weariness, by headache, and by some muscular soreness. The secretion from the membrane is often irritating to the margins of the nostrils and upper lip, and a herpetic eruption sometimes appears. The voice has a peculiar nasal tone, the eyes are often congested, and a free lachrymal secretion not unfrequently takes place. In the height of the affection the temperature is slightly, and sometimes quite markedly, elevated, and the urine is high colored and febrile.

In a few days the symptoms usually subside, though sometimes they continue on for much longer periods; the attacks may be frequently renewed, and the disease may assume a chronic form.

Causes.—The *causes* of a simple nasal coryza are generally exposures to cold when the body is heated, or to partial drafts, or wetting the feet, or dampness applied to the surface in other ways. Irritating gases and vapors, the spores of some plants, various irritating powders, and some unexplained atmospheric conditions are capable of producing the condition. Some persons are much more susceptible to such attacks than others, and with some they are more persistent and severe. When the inflammation extends to the throat, larynx, trachea, and bronchi, and is accompanied by a more decided catarrhal fever, the affection comes under other designations than simple nasal coryza.

Treatment.—The treatment of acute nasal catarrh, if treatment of any kind be required, is to be conducted on the same principle as that of a common cold or catarrhal fevers elsewhere described.

Confinement to the house, pediluvia, and diaphoretics—often a saline cathartic—or a few decided doses of quinine and morphine, or an opiate alone, will interrupt the symptoms promptly. The pill consisting of half a grain of quinine, half a grain of camphor, and a quarter of a grain of ext. of belladonna, advised for a common cold, is applicable here. Certain errhines, as bayberry bark, camphor, etc., will sometimes markedly relieve the local symptoms.

These cases of acute nasal, pharyngeal, and laryngeal catarrh are with some persons peculiarly liable to return, and though not becoming chronic, are serious from their frequency. Other cases, though not recurring so frequently, continue uncomfortably long, and the disease sometimes extends to the bronchi and lungs, resulting in

bronchitis, catarrhal pneumonia, and sometimes, possibly, in catarrhal phthisis.

Where such tendencies exist, and where previous coryzas have been protracted, as prompt an arrest as possible is demanded. Opium, quinine, nauseants, diaphoretics, chlorate of potash, astringents to the throat, gargles, sprays, counter-irritation, or whatever plan of treatment may be adopted should be very vigorously pursued. The uvula may be elongated, keeping up irritation and requiring to be cut off. The liability to take cold should be guarded against by judicious exposure and active exercise in the open air; but great fatigue, sitting upon damp ground, wetting the feet, keeping still when the clothing is wet by perspiration, especially in a cool and moist breeze, etc., should be avoided.

A cold morning bath, followed by frictions with a coarse towel, to excite a glow, and a walk in the open air, are preventive and useful with most persons. All, however, are not alike, and with some, repeated shower baths keep up a cold.

CHRONIC NASAL CATARRH.

Chronic Rhinorrhœa, or chronic coryza, is a much more annoying affair, both to the patient and the physician. It is sometimes the result of an acute attack, and is aggravated by exposures, but it often comes on gradually, is chronic from the beginning, and is associated with a strumous or syphilitic dyscrasia, rendering it a very obstinate affection.

Phenomena.—It is often an accompaniment and a part of a more general catarrhal affection, involving not only the nasal mucous membrane, but that of the throat, larynx, trachea, and bronchial tubes. It is more frequent in cold, damp, changeable climates; and when simple, not dependent upon any special diathesis, the symptoms are quite uniform in character, though varying in degree in different cases. Ulceration, or even abrasion of the membrane, seldom occurs except in diathetic cases. But the membrane is hyperæmic, thickened particularly over the lower turbinated bones, is sometimes dry and glazed in appearance, but oftener secretes a free quantity of mucus or muco-pus, sometimes tinged with blood, which is frequently readily discharged either from the anterior or posterior nares, but which at other times dries down upon the membrane, clogging up the passage, and is removed with much difficulty. The membrane is sometimes much thickened and protruded at points by obstruction of the orifices of the mucous glands, presenting soft or more indurated masses which readily bleed from mechanical causes, but the bleeding may be easily arrested. There

may be warty excrescences or polypi more completely closing the passage.

In a severer form, when from any cause the discharge is *fetid*, the disease is called *ozæna*.

This fetid coryza may be due to ulceration of the mucous membrane of the nasal passages, or of the sinuses communicating with them, whether the ulcerative process be simple or specific in character. It may be due to destructive disease of the bones or cartilages, to adventitious growths, or even to caries of an upper tooth and disease of the antrum. The odor may arise from the deposit of calcareous matters from the secretions, or from the retention of some foreign substance and the inflammation produced by it. It may also be due to some family or individual idiosyncrasy, where no ulceration exists, and where little or no inflammatory action is present; and finally, it may be due to the retention and decomposition of nasal excreta.

Most of the cases of *ozæna* are connected with a scrofulous or syphilitic taint, involving disease of the bones or cartilages. In some cases, however, no disease of this kind exists, the offensive odor depending upon an idiosyncrasy of the individual, as some persons have an offensive odor from their feet or other parts of the body. When such secretions are allowed to accumulate, the odor will sometimes taint the air of a large room in a short time, and may remain for hours.

When the bones are carious, in time the configuration of the nose will be affected, and sometimes the carious process will extend to the bones of the face, and even of the skull, causing great deformity.

The cartilaginous septum is sometimes penetrated, and other structural changes take place. In syphilitic and scrofulous cases with caries of the bones, surgical interference is indicated, but it is sometimes impossible to remove the dead bones. The discharge then will be kept up, and the condition of the patient becomes deplorable. In scrofula the odor is even more offensive than in syphilis.

The symptoms in ordinary cases of chronic nasal catarrh will vary in number and severity. There will sometimes be few other symptoms than some difficulty of breathing through the nostrils (though even this may not be marked), and the disagreeableness of the discharge. In other cases there will be uncomfortable sensations in the parts, and some pain in the seat of the inflammation and in the head, ears, and other parts, and derangement of the digestive organs.

Diagnosis.—The diagnosis cannot be difficult as to the existence of catarrh, but to distinguish all the special conditions will require care and attentive examinations. In order to a proper local examination, the parts must be washed out with blood-warm water, containing about a drachm of common salt, or of carbonate of soda or potash, to a

pint of water. The water may be snuffed up into the nostrils from a proper vessel, or be injected by a syringe, or applied by the nasal douche. Forceps or a sponge may be required to remove adherent matter; and by drawing the *alæ* aside, by means of a nasal speculum or a rhinoscope the parts may be inspected.

A great number of contrivances have been invented for cleansing and examining the parts, and for making applications.

Prognosis.—This varies much in different cases. In simple nasal catarrh, which has not continued too long, the case may be considered as favorable, provided the parts are kept cleansed and proper prophylactic measures are observed. Some cases, however, continue a lifetime without materially compromising its tenure; while in other cases slow poisoning takes place from the septic secretions, and the health is seriously impaired. In scrofulous, tuberculous, and syphilitic subjects, where the bones and cartilages become involved, the prognosis is more unfavorable.

In cases of ozæna from idiosyncrasy, though the disease is not dangerous to life, a complete cure is seldom effected, yet a spontaneous subsidence not unfrequently occurs as the patient approaches middle or advanced life. In other cases of ozæna the prognosis will depend upon the cause, and the extent of the destructive change. In scrofulous and syphilitic cases the system will sometimes respond to antiscrofulous and antisyphilitic remedies, but in some cases all means will prove unavailing.

Treatment.—It is important in all cases of chronic nasal catarrh to give attention to the hygienic conditions, and to correct, if possible, whatever is wrong in the general health. It is unnecessary to enumerate in detail all the general measures that may be indicated, as it might require the consideration of a great variety of conditions. The stomach, bowels, liver, kidneys, skin, etc., and their functions, will require looking after and may need regulating. The means necessary to prevent “taking cold,” already described, must be adopted. If there be a strumous condition or a tuberculous tendency, the preparations of iodine, codliver oil, hypophosphites, iron, bitter tonics, etc., may be indicated. A change of climate will sometimes be desirable. A more equable situation should be sought, either softer, or more elevated and stimulating, according to the special condition and tendency. Not unfrequently there are dyspeptic conditions which will require remedies which have been sufficiently dwelt upon. The syphilitic cases will require a thorough course of antisyphilitic remedies.

Various internal remedies have some reputation as alteratives, and are supposed to act especially on the inflamed mucous surfaces.

Among these are *Hamamelis Virginica*, or witch-hazel, alterative doses of iodide of potassium, of biniodide of mercury or bichloride of mercury, and Fowler's solution of arsenic, or Lugol's solution. These and other like agents must be adapted to each case with discrimination and judgment.

Local remedies, however, must not be neglected. Of these there are many that have obtained a legitimate or an illegitimate reputation. The advertising quacks have entered this field, and "certain and only cures" are abundant in print.

In the milder cases of simple chronic nasal catarrh, with some thickening of the membrane, with mucous discharge, much benefit may be derived from mineral astringents locally applied. The nostrils may be washed out with a warm solution, as already advised, any dried and adherent mucus may be carefully and completely removed, and once or twice a day a pinch of finely pulverized borax may be forcibly snuffed up each nostril. Nitrate of silver largely diluted with dry white sugar, triturated together to a very fine powder, may be used in the same way. A solution of it may be injected by means of a syringe, the nozzle of which is penetrated with fine holes, producing a spray. For injecting fluids into the posterior nares the extremity of the syringe must be bent.

Carbolic acid, glycerine and water, tannin and glycerine, sulphate of zinc, iodide of iron, and numerous other applications may be tried, used in a similar manner.

Tinct. of iodine or carbolic acid may readily be volatilized and inhaled from a vial. A convenient and sometimes very efficient volatile application is a solution of iodine in chloroform, twelve grains to the ounce, snuffed into the nostrils from a vial, after cleansing with the warm douche, snuffing, or syringing.

A persevering use of these several means, changing the articles and their strength according to the effects, will be successful in many cases. The patient should be warned that it will take time, and often much time, as well as great care on his part to effect a cure.

If there is much thickening and protrusion of the mucous membrane, portions may be removed by mechanical means, and the abraded surface should be touched with nitrate of silver.

This may be repeated many times, and the contraction of the cicatrices will be useful. Polypi must be removed if present, and nitrate of silver applied, as in the former case.

Sometimes a chronic catarrh is kept up by reflex irritation from diseased teeth, morbid conditions of the stomach, etc. These conditions should of course be removed.

When *ozæna* exists as an idiosyncrasy, the secretion from the

nasal surface is offensive as it is poured out, and when retained it speedily undergoes decomposition and becomes much more so. The discharge may be scanty, may dry upon the membrane, and may be removed with difficulty. The stench then often becomes intolerable. In such cases elimination from the skin, kidneys, and bowels should be promoted, and the patient should be encouraged to drink freely of water. Constant care, the free use of tepid water containing a drachm and a half to the pint of common salt or carbonate of soda, by means of the nasal douche, followed by the injection of disinfectants, such as solutions of permanganate of potash, carbolic acid, iodine, chloral hydrate, etc., will render the odor much less offensive, and will often procure relief to all the symptoms.

The scrofulous or syphilitic cases, whether inherited or acquired, may be excited, and are always aggravated by taking cold, when the offensive odor will often be decided, and there will be a bad odor of the breath aside from the discharge from the nostrils. When syphilis is inherited, the catarrh is likely to come on during the second dentition.

In some forms of this nasal catarrh the accumulated secretions are moulded to the part, and are sometimes of a cheesy consistence, resembling the cheesy masses sometimes found in the follicles of the tonsils, and exhaling a very offensive odor when crushed.

The method of procedure to remove dead bone is surgical, and need not here be described; but the difficulties attending such procedures are sometimes insuperable. Sometimes the parts are very sensitive and painful, when an ointment, containing from two to four grains of morphine to the ounce, may be used, introducing a mass the size of a pea into the nostril. Alterative and astringent applications in such cases must be used much diluted. The local applications, which have been recommended for the severer cases, are very numerous.

The chloride of lime, one drachm to a wine-glass of water; iodine, two or three grains to an ounce of glycerine; a snuff of camphor, tannin, and salicylic acid; powders containing cubeb, tannin, and camphor; the fumes of mercury, etc., are specimens of the articles which have been recommended, and found useful in different cases. Trousseau made much use of medicated powders. Calomel or red precipitate of mercury, in the proportion of a drachm to an ounce of some inert powder, was a favorite prescription. As a mild preparation, he advised subnitrate of bismuth, rubbed up with equal parts of Venetian tale, used freely. To obtain the alterative effect of these applications, they should be of sufficient strength to produce some smarting.

The nasal douche came into general use a few years ago, but

from being often used with cold water, and in a reckless manner, irritation and inflammation of the Eustachian tube and the ear, pain in the nostrils and the frontal sinuses, etc., often followed, and it has been quite generally condemned and abandoned. It is, however, often beneficial in its effects when used cautiously, and with solutions about the temperature and specific gravity of the blood. It consists of a tube, connected with a vessel of fluid placed at a moderate height. It is used by placing the nozzle of the tube in the nostril, closing the part about it by pressure, leaning the head forward and opening the mouth, when the liquid pressing in at one nostril flows out from the other, thus irrigating the whole of the nasal passages.

The treatment of nasal catarrh is sufficiently simple in theory, and the therapeutic principles are easily understood, but to carry them out successfully, adapting the remedies to the different cases, requires care and skill.

ANOSMIA.

Loss of the sense of smell may result from various causes—from disease of the membrane, often in the case of chronic nasal catarrh; from disease of the olfactory nerves, in their course or at their origin in the brain; from blows on the head, etc.

When traceable to a recognized cause, that, if possible, should be removed. Its impairment from catarrh may be removed by the removal of the cause. When it is entirely lost, its restoration is very doubtful.

Electricity or galvanism may be tried, with some hope of benefit. An opposite condition of morbid acuteness of smell, at least of a temporary character, may occur; and sometimes the olfactory function is so perverted that vivid smells are experienced when no corresponding odorous substance is present.

The poet speaks of “dying of a rose in aromatic pain,” and the physician sometimes witnesses in very sensitive persons, with certain idiosyncrasies, painful and prostrating effects from odors generally regarded as agreeable. Such cases are scarcely amenable to treatment, though improvement of the general health will often lessen such unpleasant susceptibilities.

EPISTAXIS, OR NASAL HEMORRHAGE,

is an accident which may occur under a variety of conditions. The Schneiderian membrane is very vascular, the vessels are very near the surface, and are readily ruptured, so that hemorrhages from this surface are frequent. Epistaxis is common in typhoid fever,

or when there is a hemorrhagic diathesis, in certain dyscrasias where the blood is in a morbid condition; and it may result from a "determination of blood" to the head, or congestions from whatever cause. It may be produced by local causes acting upon the part, as ulcerations, abrasions, nasal polypi, traumatic injuries, etc. When dependent upon congestion, it may be preceded by a sense of fullness in the head, by cephalalgia, vertigo, noises in the ears, etc., which the bleeding will relieve. Too often, however, it occurs in low and anæmic conditions, with a thin and watery state of the blood, when its effects are very injurious.

The symptoms are too obvious and well known to require a particular description. When the hemorrhage is profuse, it may lead to faintness and great debility, and in some cases may endanger life. Sometimes the bleeding is periodical, dependent upon a malarial influence, or it may be the result of tumors deep in the parts, or connected with the brain.

Nosebleed is sometimes vicarious of menstruation, or the alternate of bleeding hemorrhoids.

The diagnosis is not difficult if the patient is seen when the blood is flowing; but if it occurs in sleep, the blood may be swallowed and afterward vomited, when its source may be doubtful. The absence of gastric symptoms, and the previous or subsequent occurrence of epistaxis, will aid correct conclusions.

Treatment.—An important part of the treatment will be prophylactic, aiming at the causes inducing it. The necessary means will be various, depending upon the special conditions which have been mentioned. Constipation, menstrual derangements, anæmia, etc., will require general remedies. Ulcerations, abrasions, morbid growths, and other local conditions will require their appropriate treatment.

For arresting the flow of blood, the application of cold is perhaps most frequently used, and is often efficient. Bits of ice may be introduced into the nostrils, or snow or ice may be applied to the external part of the nose, or to the back of the neck; or cold water may be snuffed into the nostrils or be dashed upon the neck or upon the genital organs. More efficient than any other simple measure, and one which the patient or friends may, if properly instructed, effectually use, is the act of seizing the nose just below the nasal bones, and pressing the cartilaginous part of the nostrils firmly together, and steadily holding the parts in that position until the bleeding ceases, and for some time afterward. Sometimes the bleeding is from a part so far back that this will not be effectual, but in a very large proportion of cases it will be entirely successful.

Should this and the application of cold fail, solutions of tannin, alum, acetate of lead, or Mousell's salt may be snuffed up or thrown into the nostrils. These means may be supplemented by arterial sedatives, and by the internal or hypodermic use of ergotine, where the symptoms are such as to demand such measures. As a last resort, plugging the posterior and anterior nares may be required.

DISEASES OF THE LARYNX AND TRACHEA.

These organs are so intimately connected anatomically and functionally, that they may be mentioned together in treating of their pathological states; but though they are not unfrequently affected simultaneously and alike, yet they are by no means always so, and most of their diseases may best be treated of separately.

LARYNGITIS.

Inflammation of the larynx may be acute or chronic.

Acute laryngitis, catarrhal, erythematous, or mucous laryngitis, or laryngitis simplex, is a non-specific inflammation of the larynx, often extending to the trachea and sometimes to the pharynx, and it is generally confined to the mucous surface, or to this and the immediate submucous tissue. Such inflammation may commence in the larynx and spread to other surfaces, or may commence in the neighboring parts and extend to this.

Secondary inflammations of the larynx of a specific character not unfrequently occur, as in scarlatina and small-pox, and an inflammation of the part may be traumatic—from mechanical or chemical injuries.

Causes.—Acute idiopathic laryngitis, or acute catarrh of the larynx, usually arises from exposure to cold and moisture; and in those subject to sore throats light exposures may induce the disease. It is particularly liable to occur in persons who have been affected with diseases which have implicated the throat, such as diphtheria, scarlatina, and measles; and acute inflammations are liable to supervene in the course of chronic laryngitis and in tuberculous or syphilitic patients. It may be induced by violent exertions of the voice, especially if the person is heated at the time and is exposed to cold afterward, by speaking in the open air, the inhalation of dust, and of various aeriform substances, such as ammoniacal or chlorine gases, tobacco fumes, etc. Operations upon the larynx or other parts of the throat, and

caustic or irritating applications come under the head of traumatic injuries.

Phenomena.—From whatever cause arising, an inflammation that is neither severe nor extensive may seriously interfere with the respiratory function, since a moderate amount of swelling may close the narrow passages of the parts and prevent the proper inflow of air.

Although the inflammation is generally superficial, it sometimes extends to deeper parts, involving not only the submucous tissues but the muscles, and possibly the coverings of the cartilages, or the cartilages themselves. In erysipelatous laryngitis, and in other forms of specific inflammations of the part, the disease is often deep seated or phlegmonous, and abscesses may form in the laryngeal tissues.

Superficial laryngitis may be limited to the part of the membrane covering the vocal cords, or to other parts, but usually the whole surface is more or less affected.

The milder forms of laryngitis are very common, but the severer forms in adults are more rare.

The pathological anatomy is that of inflammation of mucous surfaces generally, and need not be particularly described. Hyperæmia, exudations of mucus, and, in the severe cases, of pus, and sometimes fibrous, corpuscular, and plastic exudations occur; these simple forms of the disease approaching the croupous and diphtheritic affections of the part.

In *mild* cases there is very little swelling of the part, but the membrane is a fiery red, the pain may be considerable, the voice rough, hoarse, or piping, but there will be little or no fever or impediment to breathing. In the severer cases, and where the deeper tissues are involved, there will be fever and dyspnoea, the latter sometimes extreme and suffocating. In these cases the swelling is more decided, serous or sero-fibrinous, or rarely hemorrhagic infiltration taking place into the mucous and submucous tissues, and producing a form of œdema of the larynx. On laryngoscopic inspection the parts will appear opaque, and not translucent, as in simple serous œdema, with less inflammation of the part itself. Here the membrane is tense and congested, and though the inflammation and fever may not be severe, the strong tendency to, and actual effusion into the tissue causes dyspnoea and may result in suffocation.

The symptomatic phenomena of acute idiopathic laryngitis, when at all severe, consist, as in other inflammations at their beginning, of a chill, soon followed by a fever and soreness of the part, with more or less pain of a scratching or burning character, increased by coughing, by speaking, and often by the inhalation of cold air. There is a sense of constriction in the part, doubtless due to some extent to

abnormal muscular action, but also to the swelling and stiffening which exists. The voice is generally affected ; it may be hoarse, dull, and hollow, though occasionally shrill and piping ; and efforts at speaking are sometimes followed by wheezing and prolonged efforts of inspiration. There is more or less dysphonia, and sometimes actual aphonia, from a paralyzed condition of the vocal cords, usually from interstitial deposits among their fibres. A sonorous, croupy, or cœing respiratory sound is often produced, and a shrill croupy cough, accompanied usually by a viscid expectoration, is present. In the severest cases, as the inflammation progresses the fever increases, the local symptoms become exaggerated, suffocative paroxysms of spasm of the glottis and dyspnœa ensue, the countenance becomes cyanotic, and unless relief is obtained or the morbid process subsides, gradual suffocation, coma, and finally asphyxia, terminate in death. Sometimes by a spasmodic closure of the glottis, or sudden œdema of that opening, speedy suffocation and death are produced. During the course of the disease there will be more or less anxiety on the part of the patient as to the result, and difficulty of swallowing is often experienced.

The diagnosis is to be made by observing the symptoms described, but more positively by inspection with the laryngoscope. This instrument, with the method of its use, is described in special works on the subject. It is of value in these cases as a means of diagnosis, and sometimes as an aid in treatment, especially where œdema of the glottis complicates a case ; but it is more important and useful in ulcerations and morbid growths in these parts.

The *course* and *termination* of acute idiopathic laryngitis vary according to the severity and form of the disease. In the mild cases the prognosis is favorable, and the termination in recovery occurs in a week or ten days. In some cases the disease passes into a chronic form, and may be indefinitely continued.

In the severer forms of the disease the prognosis of course is less favorable ; but still, under proper management, a large proportion recover. In those of deuteropathic origin, accompanying small-pox and scarlatina, diphtheria and erysipelas, much will depend upon the character and severity of the primary and principal disease, but such cases are apt to be grave.

Although simple acute laryngitis usually subsides without leaving any perceptible traces, it may be followed by ulceration, or become the starting-point of morbid growths, or of a chronic form of the disease.

Treatment.—The treatment of acute laryngitis will not very materially differ from that already recommended in other cases of inflammatory sore throat.

In the severer cases the patient should be sent to bed, and in all cases the room should be warm, and of a uniform temperature, but not too hot ; and it is better to keep the air moist by the evaporation of water in the room. If the stomach should be loaded, an emetic might be given with the greatest propriety, and unless the bowels are free, a cathartic should be promptly administered. A pediluvium should be prescribed, and the throat might be steamed, in the manner before advised in tonsilitis, with decided advantage. A mustard plaster, soon replaced by fomentations or a warm poultice, will be well, though some prefer a cold local pack. Tincture of aconite in small and repeated doses is a favorite remedy with some, and small and repeated doses of tartarized antimony are preferred by others. These remedies have undoubtedly a tendency to diminish the severity of the inflammation and abate the fever ; but more efficient than these are free antipyretic or antiphlogistic doses of quinine and morphine. Six or eight grains of quinine with $\frac{1}{4}$ of a grain of morphine, for an adult—the quinine repeated in two or three hours, with the addition of morphine from time to time as may be required to keep up, by the combination, an anodyne, diaphoretic, and antipyretic effect for from eighteen to twenty-four hours or longer in a severe case—will seldom fail to have a decided effect in checking and often arresting the inflammatory process. Quinine and morphine given at the beginning of an attack will seldom fail to markedly check or completely arrest the disease.

Steaming may be repeated from time to time, and will aid in arresting the disease. The salicylate of soda may be equally efficient, given in large doses ; but my confidence from experience is greater in the quinine and morphine.

If spasms of the glottis appear, the bromide of potassium in twenty to thirty grain doses may be added to any other means made use of. Its effects in diminishing the irritability of parts about the throat is well established.

The jaborandi, from its powerful diaphoretic and sialagogue effects, may be very useful ; but this is a suggestion from physiological and therapeutical principles, rather than a conclusion from facts of my own experience.

In very mild cases no decided perturbing treatment may be required. Confinement to the house, some soothing troches, as of licorice, gum acacia, and chlorate of potash, may be sufficient.

In other cases a little more severe, the administration of salines and the inhalation of the steam of warm water, or the spray of some astringent solutions, as alum or sulphate of zinc, three or four grains to the ounce, might be useful, together with rest of the larynx, general

quiet, and an even temperature. In the severer cases some advise the use of mercury, and a dose or two to be followed by a saline purgative will often be useful.

Besides these general measures, local applications and measures are worthy of being considered. The steaming that has already been advised is of sufficient importance in severe cases to be insisted upon.

Some have advised strong solutions of nitrate of silver by probang or spray or douche, but in acute cases they are more likely to do harm than good, and should generally be avoided.

In severe cases with much infiltration and tumefaction, early scarification may be of decided service; and when œdema of the glottis occurs, incisions into the tumefied part, so as to discharge the accumulated fluid, may be the means of preventing absolute suffocation.

The laryngoscope will be of service in the operation, but without it a curved bistoury guided by the finger may enable the skillful manipulator to relieve the œdematous condition and abate the inflammatory action by unloading the vessels.

Should these means fail, and the dyspnœa become alarming, tracheotomy should be promptly performed. The operation is usually harmless, and it should not be deferred until the blood has become so carbonized as to prevent efficient oxygenation after the mechanical impediment to respiration has been removed.

In traumatic laryngitis destruction of tissue may be present, and a long process will be required to effect restoration—which may indeed be impossible.

For the inflammation, the same general principles of treatment will be applicable. Abscesses are sometimes formed which will require opening, often early, to prevent their traveling, or their interfering with respiration. Anatomical knowledge and manipulative skill are necessary in such cases.

Acute laryngitis in children is the same disease just treated of in the adult, but in consequence of the narrower opening in the glottis, and the greater irritability of these subjects, the disease is much more dangerous in them than in adults.

The same principles of treatment are applicable in children as in adults; but as the peculiarities of the disease as occurring in these patients are dwelt upon in works on the diseases of children, the subject may be dismissed here.

Phlegmonous, suppurative, and plastic infiltrative forms of laryngitis have been referred to. They are much more severe than the catarrhal, are accompanied with a higher grade of fever, and are

followed by more profound effects. They, however, scarcely require a separate consideration, as their pathology will readily be understood, their diagnosis is made by similar means, and their treatment must be conducted on the same principles as those which have been described. Local depletion by leeches would be more applicable in these cases, and a much more guarded prognosis must be given. Fortunately, cases of this kind are rare, but when they occur, fatal consequences are very apt to follow.

ERYSIPELATOUS LARYNGITIS.

Erysipelatous inflammation of the throat was mentioned in connection with epidemic erysipelas. The disease may extend into the larynx from the tongue, fauces, etc., or it may have its primary and chief seat there. When it is not transferred by a metastatic process to the skin, as sometimes occurs, it is a very severe and dangerous affection, often extending into the trachea and bronchi, and producing fatal results.

It has the anatomical characteristics of erysipelatous inflammation on other mucous surfaces—the hyperæmia, infiltration, and tendency to suppuration; and œdema of the glottis and suffocation are not unfrequent consequences. It is dependent upon the same causes as erysipelas elsewhere, and an epidemic influence is generally traceable.

The diagnosis is to be made by the rapidity and severity of the local symptoms, and the occurrence of erysipelas in other situations.

The *treatment* is both general and local—the general will not differ from that for other forms of erysipelas, and the local will embrace most of those agents which have been described. As there is great depression in these cases, a supporting course, good nourishment, tinct. of iron, and free doses of quinine are the special general remedies. A mercurial cathartic is advised by Prof. Gross, and when there is an accumulation of mucus in the air passages, he recommends an emetic. Both of these measures may be well, but the patient must not be too much depressed by evacuations or depleting measures, and the quinine and tinct. of iron must not be neglected.

Steaming the throat is unquestionably useful, and blisters to the throat or elsewhere may tend to divert the disease to external parts.

That the occurrence of erysipelatous inflammation on the skin checks and often speedily arrests that upon a mucous membrane is well known, and analogously that induced by a blister may have a similar tendency.

The application of a strong solution of nitrate of silver to the

inflamed surface has been advised, but its utility is not without question.

When suffocation is impending, the trachea may be opened, but that lives have been saved by it, Cohen affirms remains to be shown.

ŒDEMA OF THE GLOTTIS AND LARYNX.

This accident has been referred to as a result of laryngitis, but it occurs under a variety of conditions, and sometimes so suddenly without preceding symptoms as to exclude any considerable degree, at least, of inflammation as its cause.

Though often caused by inflammation, simple or specific (erysipellous, scarlatinal, in typhoid fever, etc.), affecting the submucous tissues, yet it may occur in the course of Bright's disease and in other dropsical states, and sometimes from causes not well understood.

The effusion takes place more frequently in the loose cellular tissue about the glottis, and when the rima is thus swollen, an act of inspiration is apt to draw the folds together and arrest the ingress of air, while its egress may be comparatively free. In some cases a spasmodic or paralyzed condition of the parts contributes to the suffocative results.

Cohen states that the laryngoscopic inspection of the parts shows less encroachment on the breathing space than could have been anticipated from the great difficulty of breathing, and concludes that the elements of spasm or of paralysis have, in some cases, much to do in the effects.

The symptoms, in addition to those which occur from other preceding or accompanying pathological states, are a sense of fullness or stricture of the parts, and marked dyspnoea. There is a sensation as if a foreign body was wedged in the larynx obstructing the breathing, which is usually much increased paroxysmally. A hissing, stridulous, somewhat snoring noise is produced in the paroxysms without affording relief, and these become more and more frequent, till at length the distressing symptoms are constant, unless in an earlier paroxysm the suffocation becomes complete, and death speedily ensues. Often the more violent the efforts at inspiration, the more forcibly are the œdematous folds drawn together; and these unavailing efforts produce intense distress, and the greatest agitation and alarm. Soon, however, if life continues, with a slower carbonization of the blood a condition of stupor supervenes, and death occurs with less violence and agitation.

The continuance of severe œdema of the glottis left to itself will

vary; but it is speedy in its results, death sometimes occurring in a few minutes after serious symptoms appear, while in others many hours or a few days may elapse.

The diagnosis is to be made by excluding other causes of dyspnoea, such as occur in capillary bronchitis, asthma, emphysema, and in croup; and by observing that the difficulty is in inspiration and not in expiration, as is the case, more or less, with these other affections. Spasmodic croup, laryngismus stridulus, foreign bodies or morbid growths in the parts, or pressure from tumors upon the laryngeal nerve, may produce very similar symptoms, but these conditions can usually be excluded by the history and circumstances of the case; and a more positive diagnosis may be made by passing the finger over the root of the tongue, and feeling the œdematous and smoothly-swollen condition of the top of the larynx. The laryngoscope will give the most positive information, when it is available; but in advanced stages when there is much agitation, and especially in children, its use is very difficult, and often impossible.

The treatment of œdema of the glottis, and effusions into the tissue of the larynx, if time be afforded, will consist first in efforts at removing the pathological conditions upon which they depend. Among the remedies which may be recommended, but which has not yet, so far as I know, been sanctioned by experience, is jaborandi, or, better, pilocarpin used hypodermically, so as to produce its full effects in inducing perspiration, and that profuse secretion of the parts about the throat, which would tend to unload the glands and vessels, and reduce the effusion into the tissues.

Full doses of quinine, as the œdema from the inflammation is approaching, and other means deemed necessary must not be neglected. When the symptoms are urgent, and suffocation is impending, surgical measures are demanded. Dr. Gurdon Buck, of New York, years ago proposed and practiced an operation which has sometimes been found successful. It consists in wrapping a scalpel, or, better, a curved or angular bistoury, so as to leave the point free, and passing it over the tongue, guided by the finger, incising the swollen parts, making free scarifications, and, in case pus is discovered in the region, making a free opening for its discharge. This requires care, a knowledge of the anatomy of the parts, and manual dexterity. Sometimes the act of vomiting will rupture abscesses in this region; and inducing emesis, best perhaps by the hypodermic injection of apomorphia, will sometimes be justified. The more certain and the dernier method of relief consists in opening the trachea; and in extreme cases, or where other means have failed, tracheotomy must be promptly resorted to.

The after-treatment will consist, to a large extent, in supporting measures; and when swallowing is interfered with, the patient should be sustained by rectal alimentation.

LARYNGISMUS STRIDULUS.—PSEUDO-CROUP.— SPASM OF THE GLOTTIS.

Spasm of the muscles of the larynx is a condition which occurs more frequently with children than adults, but which is sometimes observed in various conditions in persons past childhood, and oftenest in hysterical women. It is supposed to be produced by irritation of the terminal filaments of the pneumogastric nerves in the mucous membrane of the larynx, transmitted to the pneumogastric nucleus, and reflected over the recurrent or inferior laryngeal nerves—the motor nerves supplying the muscles of the larynx.

As it occurs in children and in its ordinary forms, it is secondary to an acute catarrh, involving the mucous membrane of the nose and throat and extending to the larynx and trachea, and often to the bronchi, and is usually accompanied with moderate feverishness and the ordinary symptoms of a recent cold. There is some cough and hoarseness; but toward evening the hoarseness is increased, the cough becomes more frequent and assumes a more ringing tone, and in the night the child is awakened by a brassy, resonant, and high-pitched barking cough, which is commonly called croupy. Each inspiration, especially if it be a strong one, is accompanied by a loud cooing or crowing stridor, the voice or cry has something of the same character, and the expiration is often accompanied with a wheezy sound.

The dyspnœa is often very intense—much greater than would be the case in the early stage of genuine membranous croup—the accessory respiratory muscles are brought into action, the face and lips are often bluish, the countenance may be anxious, and as in obstruction to the entrance of the air through the upper air passages, the inferior portions of the chest are drawn in and the intercostal spaces depressed in the act of inspiration. These constitute the ordinary cases of spasmodic or “false croup,” which give false impressions of the efficacy of infinitesimal doses and other inert medicines for real croup.

Sometimes the initial point of irritation is in the stomach, from undigested food or morbid secretions, and hence emetics so often procure immediate and permanent relief.

In hysterical females the pelvic organs may be the primary seat of irritation, and in them the breathing is often more stridulous—the inspiratory noise more loud and sharp than in children with colds.

In children, under appropriate treatment, and often without efficient treatment, the severe symptoms soon subside, the child falls into a sleep, to be perhaps occasionally aroused by a somewhat ringing cough ; and during the following day only the symptoms of the cold may be manifested ; but the next night the same scene may be re-enacted, though oftener the croupy attack is not renewed. If renewals take place, and especially more than one, attacks are likely to occur during the day, and apprehension may be felt of the occurrence of exudations and of membranous croup.

In a large majority of cases this disease is devoid of danger, the case progressing as a common cold, and terminating favorably in a few days. There is a catarrhal congestion and inflammation, with the usual hyperæmia, swelling of the mucous membrane, and at length an increased secretion, and the occurrence of resolution. In exceptional cases the inflammation is more severe, a plastic exudate is poured out, the croupy cough and respiration become more constant and persistent, and serious consequences follow.

Spasm of the glottis and larynx in a case of simple catarrh, or from an overloaded stomach, or congested ovaries or uterus, however violent the symptoms, is nearly free from danger. It may occur, however, in connection with more grave diseases—as real croup, diphtheria, œdema of the glottis, etc., and may then, added to the other conditions, be the immediate cause of death.

The *diagnosis* in this disease is important to be made, and is determined by the manner of its occurrence, the accompanying conditions, and the speediness of relief. The laryngoscope might aid diagnosis when doubt existed.

Treatment.—This, provided the diagnosis is clearly made, need be only mild and simple. Children usually vomit easily, and an emetic of ipecacuanha will do no harm, and will commonly produce prompt relief. As domestic remedies onion syrup, oil and treacle, snuff sprinkled upon a greased cloth or paper and applied to the throat and chest, are thought by mothers to be efficacious.

Those inclined to hydropathy have even greater confidence in a “wet pack” or compresses, hot or cold ; and those who give their confidence to so-called homeopathy are strengthened in their faith in the wonderful efficacy of the pleasant medicines which the little ones are quite willing to take, by the improvement which follows, but not as a consequence of the infinitesimal doses.

The use of hive syrup, a remedy in many houses, is often very promptly followed by relief ; but, composed as it is of antimony, senega, and squills, it is more powerful than is required in ordinary cases, and is often too irritating and depressing to delicate little

patients. From five to ten grains, according to the age of the child, of bromide of potassium, will often be of decided service, diminishing the sensibility of the throat and arresting spasmodic action. A dose of paregoric will often procure prompt relief; and when the inflammation is more decided, quinine and morphine, or jaborandi, or the muriate of pilocarpin, in a dose from the tenth to the fifteenth of a grain, will arrest the spasm when its effects are produced. A laxative, as a dose of castor-oil, will often be useful, especially if the intestines be loaded.

Children subject to such attacks should be well protected in their dress, but it is a mistake to keep them too closely confined in-doors, and a daily cool bath lessens susceptibility to cold. In feeble children a tonic course may be demanded.

Hysterical cases should be treated as for other manifestations of that protean disease. The standard asafoetida is often useful, but the bromide of potassium is often quite as much or more so, and should be given in decided doses. In any of the cases the inhalation of ether or chloroform, though not to the extent of full anæsthesia, will temporarily, and often more permanently, arrest the spasms.

MEMBRANOUS LARYNGITIS AND TRACHEITIS.— TRUE CROUP.

This is an acute inflammation, mostly of the larynx, but very often of the trachea, and sometimes of the bronchi as well, in which a plastic exudate takes place which interferes with respiration, and is generally very serious in its results. By many it is regarded as identical with laryngeal diphtheria, but it appears to me quite distinct from that more constitutional affection. When diphtheria was discussed the points of difference between croup and that disease were stated, and they seem sufficient to prove the distinctive characters of the diseases.

Bartholow believes them distinct, for the reason that croup is a "purely local affection, the exudation is *on*, and not *in*, the mucous membrane, and systemic poisoning, or secondary septicæmic and infective embolic processes, never result from it."

It is a disease of childhood, and occurs most frequently in vigorous male children; it may appear at any season and any place, is sporadic, probably never occurring epidemically, is usually a primary and idiopathic affection, though it may complicate the acute infective diseases, especially measles; in these cases, however, the phenomena resemble more those of diphtheria. Taking cold is generally sup-

posed to be an exciting cause, but it certainly often comes on without any unusual exposure. There is no evidence of its possessing contagious properties depending upon a specific poison. At present its essential cause is unknown.

Morbid Anatomy.—The anatomical changes which occur are those belonging to a severe grade of inflammation of a mucous surface. It commences with intense hyperæmia, a diffused arborescent injection of the blood-vessels, and sometimes an ecchymosed appearance. The submucous connective tissue is injected and œdematous, and the part is thickened so that the calibre of the larynx and trachea is encroached upon. The hyperæmia soon attains its maximum, when an exudate appears on the inflamed surface, at first thin and semi-transparent, but increasing in thickness until an opaque, grayish white, or yellowish false membrane is formed, varying in thickness, adhesiveness, coherence, density, and extent, but usually covering the vocal cords throughout their extent, spreading over the ventricles attached to the inner surface of the epiglottis, and frequently extending over the upper part of the trachea, and sometimes even to the remotest bronchi. The false membrane is said sometimes to extend to the fauces and tonsils, but in such cases, and especially when it commences there, diphtheria should be suspected. Sometimes the false membrane is thrown off in shreds, patches, or casts, and when this occurs early in the disease, successive exudates may take place. It is usually some lines in thickness, and is commonly sufficient, together with the swelling of the membrane, to so contract the lumen of the larynx or trachea, or both, as to produce the greatest difficulty of breathing, and ultimately to induce asphyxia and death.

On microscopic examination of this false membrane it is found to consist of a fibrinous network, in the interstices of which are held corpuscles from the tissue and leucocytes from the blood. Not long after its formation, if the patient survive, a process of detachment begins, by the pouring out of serum mingled with cast-off epithelial cells, mucus, and pus, and sometimes red blood corpuscles.

The mucous membrane, when the exudate is detached, is found to be less disorganized than after the detachment of a diphtheritic membrane, and this is thought to constitute a material and distinctive difference between diphtheria and croup. When the false membrane extends into the bronchi it usually becomes less fibrinous and more corpuscular, and at length is often a muco-purulent fluid as in severe cases of bronchitis. Indeed, a bronchitis is a frequent accompaniment of croup, and sometimes a bronchopneumonia is present. In fatal cases, emphysema is often found in some parts of the lungs and collapse in others, both being produced on mechani-

cal principles—the emphysema from the distention arising from the air not passing out of the chest as freely as in, because of the more violent inspiratory effort compared with the expiratory; while the collapse is produced by some of the bronchi being completely closed, and the air in the portions of the lungs supplied by such bronchi being absorbed away. Compensatory emphysema would follow any considerable amount of collapse.

Symptoms.—From what has preceded, the symptoms of croup can readily be understood.

The attack usually begins with the appearances of acute catarrh of the upper air passages. There is a sense of heat and irritation of the part, and the voice is somewhat husky; there is a cough, at first but moderately stridulous; there is fever, with its usual accompaniments of restlessness, thirst, loss of appetite, etc. There may be some dyspnoea, but at this early stage it is not as great as in false croup. Still, in some cases the spasmodic element is present, and the stridulous cough and breathing are early developed. On examination of the throat more or less hyperæmia will be seen in the fauces, and possibly slight pellicles of exudation will appear. The sub-maxillary glands may be moderately enlarged, but not to the same extent as in diphtheria, and the larynx, when pressed upon, will be found tender. Usually from one to two days, and sometimes more, are spent in this catarrhal stage, the symptoms gradually increasing, before much dyspnoea and the more fully developed croupy symptoms appear. In some cases, however, as just stated, the spasmodic condition is present early, and an attack in the night, with symptoms scarcely distinguishable from those of false croup, may usher in the affection which may prove to be a genuine membranous croup. Too confident a prognosis should not therefore be given when one is aroused in the night by an alarm of croup. But, in whatever manner approaching, the obstruction in the larynx at length appears, and is fixed and continuous, though often worse by turns. As the disease goes on, the cooing respiration—the sound so closely imitative of the cooing of the dove—becomes constant; the cough is shrill and characteristic, the voice or cry becomes more and more husky, and may be suppressed; the breathing becomes more labored; the air not passing into the lungs, through the restricted opening in the larynx, to fill the chest when the ribs are elevated, the diaphragm descends in the effort at inspiration, the lower part of the chest is pressed in, and the intercostal spaces sink under the external atmospheric weight; a cyanotic condition approaches, and at length the apnoea becomes absolute and the child is dead. In the gradual approach of the obstruction the patient may, for one, two, or three

days, though the croupy breathing is constantly going on, be sitting up and amusing himself with his toys ; but at other times the distress is very great, the paroxysms of cough are painful, and the agonized and imploring expression of the face is heart-rending to the anxious friends. The death struggle may be severe, though usually the carbonic acid poisoning induces at length drowsiness and stupor ; the eyes grow dull, and are half-closed ; the agonized expression gives place to that of indifference ; there may be occasional arousing and struggling for breath, but the comparative calm succeeds, the breathing is less deep, the heart's action and the general powers of life fail, a cold, clammy sweat appears ; the breath becomes more and more superficial, and soon ceases. In rarer instances, general convulsions occur and put an end to the scene.

In some instances, however, by efforts at coughing or in the act of vomiting, the false membrane, loosened by the more fluid exudate beneath it, is thrown up in patches or in casts of the parts, great relief is obtained, and convalescence follows. In other cases, the membrane apparently becomes liquefied and disappears with recovery ; and in still others, after portions of the membrane are discharged, new formations take place, and the patient at length succumbs.

The duration of the disease is variable. Suffocation may occur within a day or two, or the case may be protracted for a week or even more. In those which terminate early, the cause of death is apnoea, while in those continuing longer, a general paralysis or failure of power from the blood poisoning, originating, however, in the failure of the respiratory function, is the immediate cause of death.

Diagnosis.—This is important, and in the early stage, when it is most necessary to be made, it is often difficult or even impossible. From the account given, the symptomatic resemblance to pseudo-croup will have been observed.

According to Dr. Jacobi, the fever is of a higher grade in false croup than in true ; and hence a high feverish excitement in the beginning of an attack would indicate a more favorable form of disease. Regarding croup as identical with diphtheria, as Dr. Jacobi does, and including all the cases of laryngeal diphtheria among the cases of croup, this distinction is a very just and a very important one ; and cases of genuine croup, not diphtheritic, generally begin with a more moderate fever than some, but not all, of the cases of false croup. The class of patients specially liable to have spasmodic actions of the laryngeal muscles as the chief condition are impressible, and are readily thrown into paroxysms of high febrile excitement by comparatively slight causes ; and in turn, this high excitement tends to induce the spasms. But there is no uniformity in this respect, and

some cases of true croup commence with decided febrile action. However, true croup approaches more gradually than the false, but all the symptoms are far more constant, progressive, and persistent. Obstruction to respiration from inflammation, swelling, and plastic exudation, is more fixed and far less controllable than that from only slight swelling, no plastic exudate, but laryngeal spasm. There are, doubtless, however, cases where inflammation, infiltration, and swelling of the mucous membrane and submucous tissue of the larynx and trachea produce well-pronounced croup symptoms, going on even to a fatal termination, without the formation of the distinct false membrane which is considered a necessary condition of genuine membranous croup. Such cases may not be clinically distinguishable, at least without the aid of the laryngoscope, and when the pathological state is more perfectly seen *post mortem*, the question will remain as to what the disease should be called.

Symptomatically it is croup—perhaps we may say genuine croup—but pathologically it is laryngitis or laryngo-tracheitis. As this disease is more commonly named symptomatically rather than pathologically, such a case as supposed may properly be called croup, though it is not membranous croup. This affords another instance of the imperfection of our nomenclature, and of the propriety of regarding pathological conditions rather than names; and at the same time it shows the difficulty of distinguishing clinically exact pathological states. However, in most cases of severe and persistent croup, evidence, either positive or highly presumptive and clearly inferable, is presented of a false membrane, and the diagnosis is sufficiently clear.

Prognosis.—This, as the preceding account has shown, when the disease is fully developed and a membrane is formed, is exceedingly grave. Still, under treatment and possibly spontaneously, the false membrane may be gotten rid of, the inflammation may subside, and the patient recover; and by treatment sufficiently early, cases that otherwise would have developed into genuine and fatal croup, I do not doubt, may not unfrequently be saved.

The treatment is the all-important practical matter in all severe diseases; but it cannot be properly understood or judiciously pursued without the pathological knowledge which an effort has been made to furnish respecting all the diseases treated of in this work. The superficial practitioner is often impatient and neglectful of pathological descriptions; and long discussions of doubtful opinions may be out of place, and are certainly unsatisfactory in a strictly practical work; but the philosophical and intelligent physician, who desires to understand the science and art he professes, will study with care the facts respecting the nature of the diseases with which he has to deal.

The object in this work has been to avoid all unnecessary theoretical discussions, but to give all the information essential to place the student and practitioner fairly in possession of our present knowledge of the diseases embraced within its scope. With that view, less could scarcely have been said respecting the nature and phenomena of croup.

Treatment.—The treatment of croup is very naturally divided into general and local.

The most important, or at least the first to come into requisition, is the general or systemic treatment. In a disease so severe and so often fatal in its full development, prevention is a matter of the utmost urgency, and every means should be most earnestly sought for and applied to arrest it in its earlier stages. Many diseases which in their incipency are under the control of remedies, are much less so when fully developed; and the importance of an early diagnosis and early and prompt treatment cannot be too earnestly or too frequently urged. In a case of incipient croup the patient should be put to bed, the extremities warmed, and if the stomach be loaded with undigested food or foul secretions, an emetic should be given. The nausea and vomiting, besides removing a source of reflex irritation, by the relaxation, the free secretion from the skin, and especially from the glands and mucous membrane of the throat, tend to relieve the congestion and check the inflammatory process. It will usually also be well to move the bowels by a quickly acting cathartic, and a few grains of calomel with a dose of castor-oil may be given. Subsequently, and throughout the course of the disease, the bowels should be kept open, and for this purpose an occasional purgative may be required. There are those who believe in the efficacy of mercury to prevent plastic exudations, and who would advise repeated doses of calomel. The effect of this agent is too uncertain, and at all events is too slow upon the general system to be depended upon to arrest early the progress of the disease, and in some cases active cathartic effects are too debilitating. Moving the bowels by enemata may not unfrequently be preferable. After these first evacuations, or before, if there be no evidence of an oppressed stomach, or if the bowels be free, several remedies present themselves which have a reputation and a greater or less power of checking in its early stages inflammatory action. That in which I have most confidence is a combination of quinine and morphine in doses large enough to obtain its thorough relaxing, soothing, diaphoretic, and antipyretic effects. Children bear quinine well, and in large doses, but morphine not in as large proportionate doses as adults, though its full proper effect should be obtained. Perhaps a combination of morphine and atropine, in the proportion of one part of morphine to

$\frac{1}{2}$ of atropine, added to the quinine, will produce a safer and better effect, but with the use of this mixture in combination with quinine I have not had experience in such cases; morphine alone, however, with the quinine, is certainly often attended by the most prompt and decided effects in arresting early inflammatory processes. The doses of quinine should be equivalent to from eight to fifteen grains for an adult once in from two to four hours, there being added to the first dose of quinine the equivalent to an adult of from one fourth to one third of a grain of morphine, and as much to each subsequent dose as may be necessary to moderately contract the pupil and produce a gentle but decided soporific effect. After the system has been kept under this influence for from fifteen to thirty hours, the jaborandi may be given in doses sufficient to procure its full physiological effect—the free sweating, salivation, etc. As croup commonly occurs in vigorous children, the heart's action will not usually be too much depressed by this remedy. After continuing this effect as long as is thought prudent—not many hours*—the quinine may again be resorted to in full doses, with a view of checking exudation, though it fails to arrest the inflammatory process. The chlorate of potash may be added, or what is perhaps better, the bromide of ammonium; and this latter may be given in connection with the other remedies from an earlier stage. The bromides have an effect to lessen sensibility of these parts, and will aid other agents in allaying the spasmodic element which is so apt to be present, increasing the distress and danger. When evidence of the formation of false membrane occurs, and its presence is causing obstruction, the mechanical effect of emesis is often important for the purpose of its dislodgment. Emetics have long been held an important class of remedies in the treatment of croup. The particular articles having most reputation are the sulphate or subsulphate of mercury, alum, and apomorphia. Prof. Meigs, of Philadelphia, was very favorable to the alum, and Prof. Barker, of New York, thinks the mercurial sulphate has special virtues. These have long been used, but the apomorphia is of more recent introduction. They are not only given to dislodge the membrane, but to check its formation, and they are advised to be given early and before severe symptoms occur. That they are often useful I have no doubt, and their occasional use need not interfere with the other remedies advised. Their oft-repeated and continued use would interfere with other means, and would, moreover, irritate and

* Since this recommendation of the jaborandi was written, my attention has been called to the experience of Guttman with pilocarpin in diphtheria, which strongly confirms my impression of the utility of this powerful agent in cases of this kind.

depress the patient too much, but used with discrimination they will often serve a very important purpose.

Where spasmodic action is a prominent condition, and is not allayed by the bromides or other means, the chloral hydrate is said to be effectual for that purpose. Inhalation of chloroform for this purpose is prompt and efficient, at least temporarily, and can be more perfectly controlled in its action than chloral hydrate: and as its use may be repeated when required, it may answer this purpose more safely and as well. It must be used cautiously, and not carried to the extent of full anæsthesia.

For relieving the depression of shock, ammonia and alcohol are prescribed. The first is thought to exert some power in rendering the exudate less plastic and tenacious, while it exerts a stimulating effect; and the alcohol, by relieving shock, sustains the heart's action when great depression exists.

Nourishing food should be given as is required and can be borne, a moist atmosphere, as in other cases of cynanche, will be useful, and all hygienic rules must be observed.

These are the general means which in my judgment are the most worthy of confidence.

The local treatment of croup is worthy of attention. The application of leeches to the throat may be regarded as a local remedy, though the effect is also general. The local abstraction of blood in the active stage of the inflammation is strongly advised by many of the highest authority, and in vigorous plethoric patients I have no doubt of its propriety, while I still have more confidence in the other means recommended. A great variety of applications have been recommended and applied to the throat in croup. Externally both heat and cold have had their advocates. Dr. Carson, of Pennsylvania, and others have applied ice to the throat with alleged success. Dr. Betz advises a bladder of finely powdered ice fastened to the front of the neck by a light bandage, and persistently retained. Many have recommended wet local packs or compresses, hot and cold, and relief to the sensations at least is often procured by them.

At one time the use of caustics, especially very strong solutions of nitrate of silver, was much in vogue; but these applications have not sustained their reputation. Though some cases seem to be benefited by them, they are more likely to do harm than good. As in diphtheria, unirritating solvents, at the head of which stands lime-water, may be of some use. This article may be applied by a large probang, or by spray with an atomizer, or the fumes from lime in process of slacking in a wide-mouthed bottle may be inhaled.

Lactic acid has some effect as a solvent on false membrane. Its

use is safe, and it seems sometimes efficient. This is to be used as recommended in diphtheria. Preparations of pepsin have been advised as local solvents. Chlorate of potash in saturated solution is preferred by some. Bromide of potassium and of ammonium are used by spray—some add fluid extract of belladonna to the solutions, and use as spray until the pupils are dilated. When spasm is present, this combination will be likely to be useful. The following formula has authority in its favor: \mathcal{R} Bromine, gr. j. ; Bromide of Potassium, from grs. v. to 3j. ; Water, 3j. \mathcal{M} . To be used with atomizer. This may be alternated with the use of lime-water. The muriated tinct. of iron, used undiluted, and applied by a camel's-hair brush, has much reputation, and whenever an astringent is required this is efficient and at the same time but slightly irritating. Steaming the throat is often useful here as well as in diphtheria, and various medicinal substances may be added to the steam of hot water. These and various other local measures may aid the general remedies, but they should by no means be relied upon exclusively. After the membrane is formed, these and all other remedies are only useful in conducting the case through ; the more efficient and curative treatment, if such is even then possible, is to be applied in the early stage, and must be systemic rather than local.

As an ultimate resort to avoid asphyxia, two means have been used, viz., the inhalation of air made rich with oxygen gas, so that a less quantity would supply more oxygen to the blood ; and opening the trachea below the laryngeal stenosis. The first method may be tried where the facilities are at hand ; but tracheotomy is more certain to let the vital element into the lungs. It is by no means always or generally successful in saving life, even when the chief obstruction is in the larynx, but it is sometimes so, and the patient should not be allowed to die of suffocation without having this last chance. It accomplishes a single object, but a vital one, that of permitting air to flow freely into the lungs. The operation itself, with its results, is not without danger ; but when death is inevitable without it, there should be no hesitancy in its performance. It will at least give temporary relief, unless the obstruction is below the point of the operation, which is not usual.

Any complications, such as pneumonia, must be managed according to the conditions presented.

From the account of the disease which has preceded, it will, of course, be seen that all cases are not alike, and that different cases and different stages of the same case require different remedies. Here, as elsewhere, cases of disease must be individualized, and not treated by name or in a routine manner. He is an empirical and an

unsafe practitioner who, neglectful of pathological conditions and the stages and particular states of patients, seeks for remedies and formulas, advised by however high authority, and uses them in an indiscriminate way. There must be a selection of means, and to produce the very best results a considerable range of remedies must be at command. All the remedies advised cannot be used in any one case, and there are other means not mentioned here that may be better adapted to particular cases.

It would be an easy matter to multiply the number of remedies and modes of treatment which have been advised by eminent authorities for croup, and the temptation is to present so many as to produce confusion rather than aid in the establishment of definite views.

It may be proper to add a few other methods, or modifications of methods, advised by well-known writers. Sir Thomas Watson recommends bleeding when the patient is strong and plethoric, and is seen in the onset of the disease, and, after the bleeding, antimony in half-grain doses in a table-spoonful of water, for a child two or three years old, every half hour, till sickness and vomiting ensue. When the tartar emetic causes pallor and sinking of the pulse, stop and suffer the heart to recover itself. When this occurs, and the difficulty of breathing returns, have recourse again to the same remedy. When faintness and collapse occur, a few doses of sal volatile, or a little brandy mixed with water, should be given. If no ground is gained after two or three repetitions of the emetic treatment, then it may be well to make a trial of the calomel plan. Tracheotomy as a dernier ressort. This plan, substantially, has had a large following. In my earlier practice I gave this a trial. In many cases the disease was arrested in its early stages, but doubts may well be entertained as to whether such cases would have developed into genuine membranous croup. The other plan which I have recommended I believe to be more efficient and less dangerous, though an occasional loss of blood, or a frequent initiatory emetic is, in my judgment, proper.

Dr. Aitken advises the warm bath, with heat and sinapisms to the extremities, purgative enemata, cold effusion to the head and face, and slapping the chest and nates with a wet and cold cloth, movement of the arms for artificial respiration, taking care to draw the tongue forward, and applying ether or ammonia to the nostrils when the fits of dyspnoea are excessive, belladonna and a bromide during the intervals, and sinapisms and liniments to the spine. Some of these suggestions may be of value, especially in cases where sudden attacks of extreme dyspnoea threaten serious and immediate results.

Dr. Niemeyer applies leeches over the throat when croupous patches are visible on the fauces, followed by cold compresses fre-

quently changed ; clysters of cold vinegar and water (one to three) when the bowels are confined ; an active emetic if the respiration is impeded, and the application of the solution of nitrate of silver to the entrance of the glottis at intervals of several hours. He gives calomel in small but repeated doses, and stimulants when carbonic acid poisoning occurs, rousing the patient by pouring cold water upon him while in a warm bath. Flying blisters are also advised.

Dr. B. Fordyce Barker uses tincture veratrum viride in one or two drop doses, sometimes combined with carbonate of ammonia, and followed by *large doses of quinine* in severe cases.

These will serve as specimens of different views, and are added to give the benefit of a wider selection to those who may not be satisfied with the treatment which I have seen fit to advise.

Acute diseases of the trachea are scarcely distinguishable from those of the larynx, and the same principles of treatment apply in the main to both. Indeed, when one part of this continuous surface is affected, the other is likely to be, and a separate consideration of the acute diseases of this organ is not called for.

CHRONIC LARYNGITIS.

By this is understood an inflammation of the larynx, which often, however, extends to the trachea in one direction, and to the fauces in the other, and which is of a less active but more persistent character than the acute affections of these parts which have been described.

There are three forms of this affection which are recognized : First, a simple laryngitis, which has taken a chronic form ; second, *aphonia clericorum*, a somewhat peculiar form, often combined with follicular pharyngitis, and sometimes with a mild bronchitis ; and third, ulcerative laryngitis, connected especially with pulmonary tuberculosis and constitutional syphilis. In both of the latter the fauces may be involved, but much more in the syphilitic than in the tuberculous variety. All of these chronic forms are liable to exacerbations, and rarely to rapid cedema of the submucous tissue.

The simple chronic form is usually the result or the continuance of the acute catarrhal irritation and inflammation—the effect often of repeated colds, or other causes that were described as producing chronic pharyngitis.

The minister's sore throat, as it is called, is but a slight modification of this, but is usually the result of long-continued exertion of the throat in public speaking or singing, together with sedentary habits, dyspeptic and nervous derangements, and often with mental emo-

tions. The symptoms are like those of ordinary chronic laryngitis and pharyngitis, though often less severe. There is often little to complain of, except a sense of dryness in the part, some degree of hoarseness, and a tendency to clear the throat. Examined by the laryngoscope, hyperæmia and thickening of the membrane of the larynx will be observed, with hypertrophy of the laryngeal glands, and visible enlargement of their orifices.

The laryngeal affection which so often accompanies pulmonary phthisis comes on insidiously, and is sometimes much in advance of the pulmonary lesion. It is commonly progressive and incurable, and will be more fully considered in connection with the disease of which it is a part.

Syphilitic laryngitis is one of the manifestations of that dyscrasia, and will not here be particularly described. In both these latter forms ulcerations are apt to take place, the epiglottis often suffers, and necrosis of the various cartilages frequently results. Various consequences of a serious, and sometimes fatal, character follow, among which are the formation of abscesses, oedema of the tissues of the neck, fetid breath, and purulent discharges; the occasional suppuration of portions of cartilage, which may obstruct breathing; great difficulty of swallowing from destruction of the epiglottis, and the passage of food or drink in the larynx; and in case of healing of the syphilitic variety, cicatricial contractions and permanent constriction of the part.

The treatment of these syphilitic cases will consist in a prompt use of the constitutional antisyphilitic remedies—iodide of potassium, mercury, etc.—and in the use of antiseptic, astringent, sometimes caustic and other local means, with a view of checking ulcerative processes. The reader is referred to works on surgery, and to the special works on syphilis, for full accounts of this affection and its treatment.

Simple chronic laryngitis, and what is known as the minister's sore throat, has pathological characters and causes similar to chronic pharyngitis, which has already been discussed, and to which the reader is referred. When the locality is more particularly in the larynx, an itching and scratching irritation is felt in the part, combined often with a sense of heat and the apparent presence of a foreign substance, which leads to hawking and efforts to clear the throat. Exposure to cold air increases these sensations, and especially speaking in the open air. The voice is changed, becoming husky, hoarse, rasping, and deep, or it may be high pitched, suddenly passing into a falsetto. Sounds are often produced with difficulty, and a strained and variegated character is given to the voice. Accumulations occur-

ring during the night produce coughing and hawking in the morning, until the throat is cleared. The severity of these symptoms varies, some cases being severe and others very mild. Occasionally, more is made of the disease than its importance deserves, and in possible cases it serves as an excuse for inefficiency. In many instances, however, it is serious and requires decided attention and care.

Its course is chronic, and it is subject to great fluctuations in severity. It may continue many years, becoming better and worse, without serious impairment of the general health. Cures may be effected by proper treatment sufficiently long continued, but the patient should be warned that this chronic disease usually requires a chronic remedy, and that his faithful coöperation will be required to accomplish satisfactory results.

The same general principles of treatment are applicable in chronic laryngitis as in chronic pharyngitis, and the full details will not be repeated. It will consist in hygienic management, general medication, and local applications.

All of these means are necessary to the best results. The parts must be given comparative rest, the general health must be carefully attended to—the stomach and bowels particularly must be regulated—the skin kept active, and alterative medicines should often be prescribed. Taking cold should be guarded against by care as to exposure, and by the use of proper clothing; but too much muffling about the throat renders it more sensitive to changes which cannot be avoided, and leads to more frequent colds. A proper medium in this respect must be observed. In some cases, a change to a more equable climate is important.

Local treatment, however, is important. As in the case of pharyngitis, nitrate of silver is more frequently useful than any other remedy. It may be used in solutions of various strength with a soft sponge probang, curved so as to be applied to the glottis, or it may be introduced into the larynx by an atomizer, a laryngeal syringe, or in powder with sugar by insufflation. Tannin and glycerine, solutions of sulphate or acetate of zinc, bromide of potassium, chlorate of potash, preparations of iodine, etc., may be used, the effects of all being carefully watched; and morphine may be added to them when there is much irritability.

Counter-irritation by tincture of iodine, ointment of iodide of mercury, or by plaster of cantharides, may also be useful. As in cases of pharyngitis, the solid nitrate of silver may sometimes be employed in the most obstinate cases. Iodide of potassium, combined with the fluid extract of witch-hazel, taken in appropriate doses, and continued for a length of time, has succeeded in some obsti-

nate cases when other means have long been used with indifferent success.

There are various other affections of the larynx which occasionally, but very rarely, occur, such as primary chondritis and perichondritis, lupus, lepra, and hypertrophy of the part, various morbid growths, etc. They come within the province of the surgeon and the specialist rather than the physician, and are treated of in the surgical and special works. To do them justice would require more space than can here be allowed.

Stricture of the trachea, especially in its lower part, is often beyond the reach of the surgeon, and, unfortunately, it is usually beyond the aid of the physician also. It may occur from various causes, such as contraction of a healed ulcer, hyperplasias, or morbid growths in the tissues, pressure of tumors from without, etc.

It is interesting as a matter of diagnosis, and this is to be made by the dyspnoea and unavailing cough, and by a physical examination; and in case of a tumor, by evidences of its pressure upon other parts. A tumor in the neck pressing upon the trachea may be removable; and, in that case, proper treatment would require its removal. In some other cases surgical interference might be available, but otherwise the treatment would be symptomatic.

DISEASES OF THE PARIETES OF THE CHEST.

PLEURODYNIA.

Pleurodynia is pain in the walls of the chest. The term is not a very definite one, and may include either muscular or neuralgic pains. "Muscular rheumatism," an expression which is commonly used, is also somewhat indefinite, and is applied to the same cases. In these latter cases there is not only pain but tenderness—pain especially on motion. There is no fever, and generally no articular rheumatism. Respiration is more or less painful and catching, and the severest suffering is usually in the lower part of the chest.

It may be confounded with pleurisy, and its name indicates that it was formerly supposed to have its seat in the pleural membrane.

But in inflammation of the pleura there is a chill, a fever, and a much severer sense of general illness.

There may, however, be some obscurity when such pain comes on after "taking cold," and when a bronchitis is present. Occurring, as it often does, in the region of the diaphragm, it might be confounded with peritonitis. But in the latter disease there are chills,

fever, and severe illness. The entire absence of pleuritic friction sounds, or other physical signs of inflammation within the chest, will aid in the diagnosis, though it must be stated that pleuritic friction sounds are not always discoverable in the early stage of pleurisy.

It may also be mistaken for herpes zoster before the eruption appears, but a careful examination will show the pain and tenderness to be in the skin rather than in the muscular or deeper tissues of the chest walls in herpes.

Local anodynes and stimulants—soap liniments containing laudanum, chloroform, or tinct. of aconite, or belladonna plasters—will often give relief. Dry cupping, warm vapor baths, and hot fomentations, have been recommended and are useful. The application of dry heat, as by a smoothing-iron heated to 212° in boiling water and passed over the part (a cloth intervening) as hot as can be borne, will often relieve promptly this and other forms of muscular or aponeurotic pains.

Rest and time are important elements in the treatment, but they may often be aided by the means above indicated. If a real rheumatic element is present, anti-rheumatic treatment—salicylate of soda, alkalies, etc.—may be required.

By *myalgia* of the chest walls is understood pain in the muscles of the part. This is closely allied to pleurodynia, but there is, perhaps, less tenderness in myalgia. Myalgia is not clearly distinguishable from neuralgia. It may be reflex and connected with disease of the uterus, stomach, spine, or other parts. The local treatment will not materially differ from that of pleurodynia, and, when it is reflex, the general treatment should be chiefly directed to the primary disease.

Neuralgia of the walls of the chest occurs. In this as in neuralgia in other localities, the pain is paroxysmal and often darting, following the course of the nerves. There are usually three points in the course of an intercostal nerve more painful than the rest, viz., where the nerve emerges from the deeper parts near the spine, not far from the middle of its course, and near its extremity.

There is commonly some impairment of the chest movements, jerking and irregular respiration, and the general evidences of a neuralgic state. There is often anæmia, exhaustion, and debility from various causes; not unfrequently distinct hysterical conditions with their variable phenomena—emotional excitement, abundant pale urine, etc.

Cutaneous hyperæsthesia is a common condition; and there is very frequently what is called “spinal irritation”—tenderness and pain over and by the side of the vertebræ. This is attributed to

spinal congestion or anæmia, though in most cases the tenderness is cutaneous. There is probably some form of irregular action, or some morbid state of the spinal cord and its emerging nerves, but its precise nature is not understood. From the severity of this pain, the patient is often apprehensive of severe disease in the chest, and the fear of consumption sometimes becomes a predominant feeling.

It is to be distinguished from disease of the lungs by observing the peculiarities mentioned, and by an absence of physical signs. The temperature and the pulse should be particularly observed. In tuberculosis, especially when the disease is progressing, the temperature will be elevated, and more so toward evening, and with a degree of regularity, and the pulse will be increased in frequency at the same time and more or less constantly. In neuralgic cases the pulse may be rapid at times, but not regularly so, and it is often slow; and the temperature is commonly near the normal.

The prognosis is variable, and depends largely upon the accompanying morbid conditions. It is not of itself dangerous, but may be obstinate.

The treatment, as in other forms of neuralgia, is divided into *palliative* and *radical*. The palliative consists of counter-irritation, as by chloroform liniments, camphor, mustard, and blisters. But more effectual are hypodermic injections of morphine, or atropine, or both together, and the use of electricity.

In the more radical treatment, the causative indications must be followed. The original disease must be treated according to its nature and symptoms. Oxaluria is not unfrequently present, when the nitro-hydrochloric acid will be required. Besides attention to the conditions of the stomach, bowels, pelvic organs, liver, etc., some of which are commonly deranged, a tonic course will usually be required—quinine, iron, strychnine, etc.;—and various neurotic remedies—anodynes, antispasmodics, bromides, valerianates, chloral, zinc, arsenic, etc.—may be useful. The details of the treatment of neuralgia, however, will be more fully stated in another connection.

NEURITIS.—INFLAMMATION OF THE NERVES.

Intercostal neuritis sometimes occurs. There is in the inflammatory condition not only pain, but marked *tenderness* in the course of the nerves. This occasionally is a complication of phthisis. It should be treated as inflammation of the nerves elsewhere—locally by anodynes, fomentations, and counter-irritations; and internally by anodynes and eliminatives according to the conditions present. Free

doses of quinine and morphine will, as a rule, be more efficient than any remedy with whose effects I am familiar. The doses should be liberal, but not long continued.

PERIOSTITIS.

Inflammation of the periosteum of the *ribs* may take place, especially in strumous and syphilitic subjects. It should be distinguished from disease within the chest, and treated as in other cases of periosteal inflammation. When the diagnosis is made, and disease of the lungs is excluded, the cases become surgical.

There may be *cancer* of the ribs, *abscess* of the *sternum*, and external emphysema, and *anasarca* of the cellular tissue of the walls of the chest, which merely require naming in this connection, but which are to be distinguished from internal affections, and which sometimes embarrass the physician in his investigation of diseases within the thorax.

DISEASES OF THE DIAPHRAGM.

PARALYSIS OF THE DIAPHRAGM.

This condition rarely occurs, and may be produced by any of the common causes of paralysis in other parts. As this muscle performs by its contractions and relaxations an important part in ordinary breathing, its loss of contractile power tends to embarrass this function. When the lungs are in a healthy condition, and no extraordinary effort of respiration is necessary, as when the patient is quiet or exercising but moderately, the motion of the ribs is sufficient to carry on the function without the action of the diaphragm and without embarrassment; but in active exercise, in the excitement of fever, or in pulmonary disease, dyspnœa is experienced when the diaphragm is not in action. This condition is distinguished by the comparative immobility of the lower part of the chest, or its contraction in inspiration, and by diminished abdominal, and proportionately increased costal movements in respiration, and when the dyspnœa can be attributed to no other causes.

The treatment will be influenced by the pathological condition which occasions the symptom; and as in other cases of paralysis, electricity, especially in the advanced stages, is worthy of a trial.

Tonic Spasm of the Diaphragm is mentioned by authors, but is extremely rare. The symptoms are, more or less dyspnœa, some-

times very great, and its results—cyanosis, feebleness of the voice, etc., often accompanied with severe pain in the region. The signs are expansion instead of contraction of the chest, differing in this respect from those of paralysis of this muscle; but resembling the latter in the fact that there is costal respiration, and comparative immobility of the lower part of the chest and of the abdomen in breathing. In making a diagnosis other morbid conditions must be excluded. It has occurred in rheumatism and in tetanus.

The treatment should be directed to overcoming the spasm, while the disease with which it is associated and which gives rise to it must receive attention.

The inhalation of chloroform, the hypodermic injection of morphine, the use of fomentations, cups, and counter-irritation may be resorted to; while if it depends upon rheumatism the salicylate of soda, or salicine, etc., must be freely given.

When it depends upon tetanus the prognosis is exceedingly grave, but treatment as for other cases of this intractable disease may be tried.

Hiccough, or *clonic Spasm of the Diaphragm*, is a frequent occurrence. The spasms of the diaphragm not unfrequently take place, especially in children and in young persons, from slight causes—from laughing, or titillation, or a hearty meal, etc.; they continue for a short time only and produce but slight inconvenience. In such cases, as is well known, a sudden emotion of fright or surprise will often arrest them. Hiccough, however, is sometimes a very troublesome and alarming symptom of serious disease. When continued, as it sometimes is, for many hours, or days and even weeks, it becomes a source of great distress in itself, and in its briefer continuance is often an alarming symptom, indicating severe disease and a low state of the system. It occurs in a variety of affections, such as severe inflammations of the liver, stomach, peritoneum, pleura, etc., and in low fevers, and in various states of shock; but its pathological connection with these conditions is not fully understood. It must, however, be regarded as neuropathic; and special treatment for the symptom must be addressed to the nervous system.

Relief may be obtained by the use of various antispasmodics, such as valerian, asafoetida, musk, camphor, ether, etc. Chloroform or ether by inhalation, carried to the extent of incipient anæsthesia, will almost always arrest the hiccough, temporarily; but it is apt to return with the discontinuance of the inhalations. Relieving the shock of the system by morphine or by stimulants will sometimes succeed. Suddenly applying to the epigastrium a dry cup, the air in which has been exhausted by a burning bit of paper, or by the flame of a

few drops of alcohol or spts. of camphor, will often arrest the convulsive movement.

Counter-irritation, or revulsion by several dry cups or by other means is often useful. Compressing the epigastrium by means of a folded cloth and a firm bandage has been recommended; and where other means fail, electricity may be tried. Currents, either continuous or interrupted, may be passed through the parts, or in the course of the pneumogastric nerves.

The disease with which it is associated will of course require attention and the adaptation of treatment to its conditions.

BRONCHITIS.—CATARRHAL INFLAMMATION OF THE BRONCHI.—BRONCHIAL CATARRH.

Bronchitis is an inflammation of the mucous membrane of the bronchial tubes, in ordinary cases chiefly confined to that surface, and accompanied with modification of the secretion. This is usually diminished at first, then increased and changed in character, often being sero-mucous, mucous, corpuscular, muco-purulent, and purulent in turn. The increased secretion gives rise to expectoration, which is usually effected by cough; and the process is accompanied by moderate fever, often with some pain and soreness chiefly behind the sternum, and with more or less difficulty of breathing.

It is divided into *acute* and *chronic*, into common bronchitis when occurring in the larger and moderate-sized tubes, and capillary when occurring in the minute tubes. There are other varieties, as plastic, where the exudate is fibrinous or croupous; mechanical, from the inhalation of dust or some form of irritating materials. It is secondary when it accompanies other diseases, as typhoid, malarial, eruptive, and other fevers, or some blood diseases, obstructive heart affections, syphilis, Bright's disease, and other affections.

Acute, primary, ordinary bronchitis (not capillary) is a very common disease, usually attributed to taking cold. It is seldom fatal of itself when occurring in vigorous adults, and is frequently a comparatively mild affection; but it is not an unfrequent cause of death in young children and old and feeble persons. Capillary bronchitis is a very dangerous affection wherever it occurs; and in the common forms the inflammation is liable to extend to other tissues, the disease to become chronic and very obstinate, and sometimes to lead to a very serious and fatal disorganization of the lungs.

In view of its frequency and the serious consequences to which it often gives rise, it becomes a disease of much consequence and

interest, and a careful study of its pathology and treatment seems required.

STRUCTURE, FUNCTION, AND PATHOLOGICAL CHANGES OF THE PARTS
CONCERNED IN BRONCHITIS.

As morbid processes and structures are but modifications of normal ones, a proper understanding of them must be based upon a knowledge of the structures and actions in health ; and as the intimate structure and functions of the bronchial membrane may not be so generally understood as those of many other organs which have received more attention, some statement upon these points may be found useful.

In the presentation of the matter which is to follow, I shall avail myself, among other sources of knowledge on the subject, of the labors of D. J. Hamilton, M. B., etc., Demonstrator of Pathology, University of Edinburgh, and Pathologist to the Royal Infirmary, as published in a recent monograph.

It is a curious fact that the continuous membrane lining the bronchial tubes and the pulmonary alveoli, derived from the same germinal layer in the embryo, should be covered the one with columnar, and the other with squamous epithelium. Their different structure, however, fits them for their peculiar functions ; but their common origin suggests their intimate relations. There is a gradation in structure from the largest bronchi to the bronchioles, the infundibula, and the air vesicles. The general appearance of a larger healthy bronchus is well known. Its inner surface, lined with the mucous membrane, has a pinkish color, and when the thin coating of frothy mucous which is upon it is wiped away, the surface has a glossy and fine velvet-like appearance, and in some places it is so thin that the inner fibrous coat may be seen shining through it. The bronchus has three, and some think four coats—the mucous within, the muscular intermediate, and the fibrous without, in which last are the elliptical cartilages.

The mucous membrane, in folds in the larger but smooth in the smaller and smallest bronchi, is covered by epithelium ; and this membrane can be divided into three layers—the deeper part, next the muscular coat, being the *inner* fibrous layer of the bronchus ; a basement membrane, thin but firm, attached to this ; and the epithelial layer superficial to all. Under a proper magnifying power the cells in the epithelial layer, and constituting it, are seen to differ at different depths—those that are superficial have a *columnar* shape, those immediately under them have a transitional character, while there is a *flat* layer of cells lying on a homogeneous basement membrane.

The columnar cells when young have a firmer and broader attachment to the basement membrane, or rather to the transitional and flat layer of cells upon it, and from which they spring ; but as they become older, the attachment is more attenuated, and this finally gives way and the cell is shed. When congestion of the membrane occurs, this detachment goes on more rapidly, and when the membrane is inflamed, it soon becomes denuded of its columnar epithelium.

The flattened cells next the basement membrane have been regarded differently by different observers. Some have thought them connective tissue corpuscles, others a more permanent endothelial layer, and in the trachea such a layer seems to exist ; but in the bronchi it is alleged that these cells, though appearing flat when looked at from above, when viewed on a perpendicular section are found to be nucleated and more oval in shape, and are developed into the columnar epithelial cells, with their fringe of cilia, the motions of which are capable of producing such striking physical effects.

When the smallest bronchi are reached, just before they terminate in the infundibula and air vesicles, the different stratified layers are lost, and a single layer of somewhat cube-shaped cells is substituted ; and finally in the air vesicles the cells become very much flattened and extremely delicate, resembling the endothelial cells on a serous surface.

A very important fact, which Hamilton seems to have demonstrated, is that in the bronchi in man a thin, firm, homogeneous, almost indestructible basement membrane lies immediately under these layers of epithelial cells and over the fibrous structure, which latter is next the muscular coat, and to this basement membrane these cells are attached, and from it they spring. When the mucous coat of the bronchi is deprived of its cells, as is often the case in the inflammatory process, this basement membrane remains, giving a smooth and shining, in contradistinction to the velvety, surface formed by the epithelium. This basement membrane, though destroyed with great difficulty, is capable of undergoing changes, becomes oedematous and thickened when inflammation is present, and may be ruptured. Immediately beneath this, as before stated, is the inner fibrous coat, mainly composed of elastic fibres, with a few bundles of colorless, wavy fibres ; and this tissue is abundantly supplied with vessels from the bronchial artery, which forms a ramifying plexus immediately under and projecting into the basement membrane, supplying the latter with nourishing materials for the production of the cells upon its upper surface. This fibrous structure contains many branched connective tissue nuclei, lying in loose plasma

spaces between the bundles of fibres ; and over this tissue is a covering of endothelium, having large, oval, and extremely granular-looking nuclei.

This inner fibrous coat contains a *lymphatic system*, consisting of a branching net-work of lymphatic vessels and capillaries, plexuses of which inclose plasma spaces. Here are doubtless the radicles of the peribronchial lymphatic system, and they correspond with those seen in the walls of the pulmonary air vesicles.

The *muscular coat* lies next to the inner fibrous layer, and is so intimately connected with it that it appears more like a part of the mucous membrane than a separate investment. Between the bundles of non-striated muscular fibres, numbers of lymphatic vessels and spaces are to be seen.

The *outer fibrous coat* of the bronchi is the final covering of these tubes, and is of great importance in explaining many of the phenomena of bronchitis, especially in its chronic form, showing particularly how bronchial inflammation, when it involves the deeper tissues of the tube, may extend to other structures—to the connective tissue of the lungs, to its lymphatic and vascular system ; and the study of its structure and relations throws much light upon the long recognized, but of late still more apparent, fact of the frequent production of phthisis from bronchitis.

Without entering minutely into all the anatomical and histological peculiarities of this outer adventitious coat of the bronchi, it will answer the present purpose to state that it is composed of somewhat loosely disposed bundles of white fibrous tissue, with intermingled elastic fibres, arranged concentrically to the opening of the bronchus, and continuously passing into the similar coat which surrounds the branches of the pulmonary artery, forming an intimate connection in this direction. Tracing this coat of the bronchi in another direction, it is found to be as intimately connected with the fibrous structure which ramifies through the whole lung and separates the pulmonary lobules from each other, constituting the lobular septa, and extending on to the pleura, with which this structure is thus continuous. From this statement it will be readily seen that an inflammation, involving the fibrous envelope of the bronchi by simple continuity, may extend throughout the connective tissue of the lungs, and that its thickening and contraction will interfere with pulmonary circulation ; will compress the lung lobules, causing their atrophy and contraction, producing dilatation of the bronchi, and the formation of bronchiectatic cavities in chronic bronchitis, and causing interstitial changes throughout the lung.

It is further found that spaces of considerable size intervene

between the bundles of fibres, in which are cells and connective-tissue corpuscles, and in which carbon particles are always met with in the adult human lung, sometimes filling them completely. These spaces seem to be "lymphatic spaces," and on tracing them by the colored carbon they contain, they are found to have free communication with similar spaces around the pulmonary arteries, and probably pour their lymphatic contents into them; while traced in another direction, they are found continuous with lymphatic vessels of large size in the lobular septa. Through these lobular septa the lymphatics pass out to the deep layer of the pleura, where abundant plexuses of large lymphatics ramify; and these are without doubt connected with the bronchial glands at the base of the lungs.

Lymphatic glands are well known to exist abundantly in the human lungs. They are continued along the bronchi, to a considerable distance within the lung substance, and are found in the bronchioles, and are particularly apparent when lymphadenoid deposits occur in this situation. These facts prove the connection of the bronchi with the lymphatic glandular system in the lungs, and tend to show how a bronchitis may result in disease of these adenoid structures, and the production of tubercles which have a prominent seat in them.

Mucous glands are found in those bronchi which have cartilages in them. They consist of depressions in the mucous membrane running down upon or between the segments of cartilage, and have a duct which opens into the bronchus by a trumpet-shaped orifice, while the neck below is much constricted. The epithelium in the neck is a double layer, the outer cells being columnar and ciliated, while those in the deeper part of the little gland sac are pavement-like or spheroidal. Under these are flat, endothelial-like cells, and these rest upon a finely fibrous basement membrane; and outside of the individual, and between the grouped glands, there are numerous blood-vessels and connective-plasma spaces. •

As already stated, the columnar ciliated cells are produced from the germinal cells which lie next to the basement membrane. The nuclei in these cells divide, and this is followed by the fissiparous division of the body of the cell. Some of these new cells elongate, presenting a broadened end toward the opening or free surface of the bronchus, the cilia or hair-shaped projections like a brush appear upon the free end, and the full-formed ciliated columnar epithelium of the bronchial mucous membrane is the result. Some of the germinal cells next the basement membrane are thrown off without undergoing this full transformation, or scarcely any transformation processes, and constitute the mucous corpuscles found upon the sur-

face of the ciliated epithelium. The cells in the depressions constituting the mucous glands are also thrown off in the form of mucous corpuscles ; but the chief function of the mucous glands is to furnish the liquid part of the mucus in which the corpuscles are found.

These anatomical and physiological statements have been carried to a greater length than was at first intended, but not farther than will be useful in understanding the pathological conditions, a description of which is to follow.

Hyperæmia.—The condition of congestion of the bronchial membrane precedes that of fully developed inflammation, and though it is often merged into it, it is by no means always so, and this is particularly true of the mechanical variety. Hyperæmia of the bronchial surface is a very frequent condition, and is easily excited and by a variety of causes. Exposure to cold, chilling or wetting the feet, the inhalation of dust or irritating vapors or gases ; various internal conditions—obstructed circulation through the heart, the taking of narcotic substances, and a variety of other causes produce congestion. This frequently proceeds no farther than to increase moderately the secretion of mucus, to produce slight difficulty of breathing, and when extending to the larynx, as is usual, a slight degree of hoarseness and other mild symptoms, but not a full inflammatory process. In passive congestion of the bronchi, produced by a fatal dose of opium, it was found by Hamilton, on post-mortem examination, that in the smaller bronchi containing very small cartilages or none, there seemed no deviation from the normal state—the epithelium and all the parts were intact. In the larger bronchi, however, the whole bronchial wall, and more especially its inner fibrous coat, was in a state of acute congestion. The small arteries, veins, and capillaries, were distended and filled with blood corpuscles, and loops of these vessels were seen running to the basement membrane and projecting on its free surface. This basement membrane was œdematous, thickened in its folds, and made much more distinct than in health.

At some points the columnar epithelium was left unchanged ; but over the greater part of the membrane it had been partially or completely shed, leaving only the lower layers of cells in their places on the basement membrane. Subsequent experiments proved that in other cases such changes were not produced post mortem, and the inference was that the shedding of the columnar epithelium was the result of the congestion, and that this is readily effected in even comparatively slightly morbid conditions of the membrane.

While this exfoliation was going on, and the œdema and hyperæmia of the mucous coat was occurring, the external fibrous coat was also undergoing changes. There were accumulations of small, round

cellular structures in the interspaces of the fibres, a condition still more marked when bronchial inflammation is more fully developed. These rounded bodies were apparently leucocytes, which had escaped through the walls of the dilated blood-vessels.

It will be observed that the larger bronchi were affected while the smaller ones escaped, indicating the less liability of the latter to changes of this kind.

PATHOLOGY OF ACUTE BRONCHITIS.

Pathology.—We are now prepared to consider the pathology of acute bronchitis.

While the larynx and trachea are continuous with the bronchi, and of a very similar structure, and an inflammation of one is apt to be accompanied by that of the others ; and while in fact a cold, followed by a bronchitis, commonly commences above and extends downward, yet these parts are not always affected either simultaneously or successively. We may have an inflammation extending no farther than the larynx or trachea ; and it is very frequently the case, indeed it is the usual fact, that inflammation in the larger bronchi never reaches the smaller, particularly the smallest tubes. We may have tracheo-bronchitis, when the lower part of the trachea and the large bronchial tubes are chiefly affected ; bronchitis, more proper, when the medium-sized tubes are the principal seat of the inflammation ; and capillary bronchitis, when the smallest-sized bronchi are the particular seat. This last is usually accompanied by more or less catarrhal pneumonia—the inflammation, to a greater or less extent, extending to the alveoli. This, especially in children, is a most dangerous affection, as we shall hereafter see.

As acute bronchitis in the adult is so seldom fatal of itself, the *post-mortem* examinations which have revealed its pathology have been made in cases which were complicated with other diseases, and a sufficient number of such cases have occurred to enable pathologists to make the following statements of the appearances produced by the disease.

In a patient dying after the disease is fully established, the trachea will be found to contain quite a free quantity of catarrhal fluid, more or less viscid and frothy, and of a yellow color. The same material will be found in the smaller bronchi, but in freer quantity, especially if catarrhal pneumonia be added. In the latter case, cutting through the lung will show lobules of its structure, raised, of a grayish pink color, feeling quite soft and granular, and when pressed, a muco-purulent fluid exudes from the cut surface.

The inflammation is catarrhal rather than croupous, as the exudate is not rich in fibrine or solid in consistence, but of the same character as that produced from the bronchi in catarrh of that surface alone.

From the naked-eye examination of a case of acute bronchitis, the mucous membrane is intensely congested, but more in some points than others, giving it a more or less mottled appearance, and it is covered by this mucopurulent secretion. When the *outer* fibrous coat is observed, it does not exhibit the congested appearance and red color of other portions of the tube, but contrasts with them by its grayish-white, glistening appearance.

By examining those tubes which are evidently later involved, by means of magnifying optical aids, it appears that the first deviation is a relaxation and distention of the abundant plexus of blood-vessels—branches of the bronchial artery—ramifying in the inner fibrous coat, which, as it will be remembered, is immediately beneath the basement membrane; and, soon after, the latter membrane becomes thicker and more clear and homogeneous—evidently from œdema of its structure. The next change, occurring it is thought in twenty or thirty hours from the development of the inflammation in the part, is the desquamation of the columnar epithelium. This takes place most completely where the congestion and inflammation are most intense. Though the under layer of cells remains longer, the ciliated columnar epithelia are shed early in the attack, and take no part in the subsequent proceedings. They are either expectorated or undergo a fatty change, and thus disappear, and are not reproduced until the inflammatory action disappears or greatly subsides. When the mucous membrane is thus largely denuded of its ciliated epithelium, the process of expectoration, which is largely effected normally by the motion of the cilia, is interfered with.

After the shedding of the columnar epithelium, the lower layer of cells comes into view. In points they too are detached, but never completely removed from any considerable portion of a bronchus; and their production and speedy throwing off in an embryonic form, constitutes the mucous corpuscles in the expectoration. After they are separated they become more oval or rounded, and not unfrequently undergo fatty degeneration. They become enveloped in a quantity of liquid mucus, which is constantly being poured from the mouths of the mucous glands, and this mixture composes what is known as the catarrhal secretion. In the early stage of the inflammation, when a more watery secretion takes place, there is more or less serous fluid exuded from the vessels, or rather more directly from the œdematous basement membrane.

Mucine is secreted from gland cells, and the cells, likewise, are

specially produced and thrown off, not remaining intact or going on to their proper development. Mucous corpuscles, then, are *aborted epithelial cells*. They are not cells from the connective tissue, as the basement membrane, it is believed, presents an impassable barrier to the passage of such cells through it.

While this is going on at the surface, there is a dilatation of the blood-vessels in the deeper part, and infiltration of the inner fibrous coat with proliferating cells and leucocytes. These do not pass through the basement membrane, but out into the external fibrous coat.

It is quite certain that the white blood corpuscles are not the only source of inflammatory cells in bronchitis, but that the multiplication and enlargement of various tissue cells—their rapid production and imperfect development—constitute a large part of these cells. Some of these cells, however, are from leucocytes, as in other inflammatory processes, which were described when the general pathology of inflammation was discussed.

In a day and a half or two days after an acute bronchitic attack, these cellular infiltrations take place, and by the fourth or fifth day are increased greatly, and entirely choke up the lymph spaces already described.

From these observations it appears that the cells of the catarrhal secretion, in acute bronchitis where no ulcerative process occurs, are not from the leucocytes of the blood—do not pass through the basement membrane which is intact; but all cells produced beneath it pass in the other direction into the outer fibrous coat.

Changes in the muscular coat occur at the same time—the cells multiply, and this tissue receives leucocytes from the blood.

In the gland follicles changes occur similar to those upon the surface of the mucous membrane. Their secretion is increased and changed, and their cells are rapidly produced and aborted, and often the excretory duct or neck of the gland is choked up.

Not only is the outer fibrous membrane of the bronchi affected in the manner described, but in many cases where the disease continues for much time, or is severe, the lobular septa of the lungs, extending even to the pleura, are involved in a similar manner.

The lymphatic glands, vessels, and courses also participate in the diseased action—all of them becoming the subject of a catarrh much like that of the mucous membrane. They are congested and choked up, and add to the general diseased condition.

Hæmorrhages into the tissue of the outer fibrous coat were not unfrequently seen, and sometimes also in the basement membrane; and when in the latter situation that membrane was often ruptured

and a little blood escaped into the bronchi, appearing in the sputa in streaks during life.

The nerve ganglia and trunks have also in some cases been found affected—irritated and congested. These ganglia are abundant around the large bronchi at the root of the lungs, and have to do in influencing secretion and the muscular contraction of the bronchi and of the vessels. The influence of these morbid conditions of the ganglia and nerves has not been accurately determined. The muscular coats of the bronchi in these cases seem not to be excited.

On subsidence of the inflammation and recovery, the congestion disappears, the exudates are no longer freely poured out; those that have occurred are carried away by the lymphatics chiefly, and health is often soon, or in other cases after a longer time, restored.

In chronic cases, however, these exudates remain, or their absorption produces great surrounding irritation, ending in the production of more or less interstitial pneumonia and its consequences; and where a tuberculous diathesis exists, not unfrequently the case results in phthisis.

PATHOLOGY OF CHRONIC BRONCHITIS.

Pathology.—Chronic bronchitis is so often dependent upon acute, and has so many points of resemblance with it, that its pathology will be better understood by its presentation here, than after the course, the diagnosis, and treatment of the latter have been considered.

When bronchitis has continued long enough to be considered as decidedly chronic, such changes have generally occurred as render it one of the most obstinate diseases. An understanding of this obstinacy can only be gained by a knowledge of its pathology.

Several symptomatic varieties have been recognized—viz., a milder form of winter cough, where improvement occurs during the summer season, to be followed by aggravations as the winter approaches; a more severe variety, but influenced to a greater or less extent by the seasons; bronchorrhœa, where there is a free secretion; and a dry bronchial catarrh, where the secretion is scanty. These varieties, however, run into each other, and their distinctions are not well defined.

Again, several etiological varieties have been made; such as those dependent upon an acute attack; upon valvular lesions of the heart; upon the inhalation of irritating foreign matters; upon chronic interstitial nephritis or upon Bright's disease, or other chronic changes in the system—such as the gouty, the malarial, and other cachexias.

Perhaps the most frequent cause of the chronic form of bronchitis is an acute attack, or rather a series of acute attacks with imperfect restoration between them.

When an attack of acute bronchitis has become fully developed, when it has reached its greatest intensity, instead of always disappearing by resolution, it may become complicated with catarrhal pneumonia or it may become chronic. In some cases the acute attack is not severe, but perhaps it is neglected and exposures are repeated, and it lingers, or is aggravated from time to time, and finally becomes chronic. In these cases where the acute ends in a chronic form, the inflammation has never undergone a complete resolution, but has left the tubes and their surroundings impaired, so that slight exposures or causes, which would ordinarily have little effect, will produce great aggravation of the symptoms.

Some of the lesions that are left behind, or finally result, can be inferred from the preceding account of the pathology of the acute cases. The lesions require, however, to be briefly stated.

In a patient dying with chronic bronchitis, the lungs are usually decidedly emphysematous. When inspected their lobules are over-distended and their divisions more marked than usual, both by their distention and by deposits of pigment between them. When cut into, they collapse more or less. The mucous membrane of the bronchi will be found deeply congested and of a bluish red color, as also will usually be the lower part of the trachea. The small and middle-sized bronchi will be more or less filled with muco-purulent matter, often very viscid, of a grayish color, of almost jelly-like consistence, adhering to the walls. The mucous membrane, except when bronchial abscesses or ulcerations are present, is smooth and shining, the mouths of the mucous glands, however, are seen as little pin-point depressions when the light falls obliquely upon them. The surface is not granular, and when examined carefully will be found to consist of a thin elastic membrane which covers it, having the characters already given of the *basement membrane*. It is denuded of the columnar epithelium, the whole of the epithelial cells being thrown off in an immature or embryonic condition—only a layer of these germinal cells being found on the basement membrane.

This membrane, in chronic as in acute inflammation, presents a barrier, it is alleged, to the passage of leucocytes and all other cell elements, though not unfrequently rupture takes place in it at points, through which blood passes, staining the sputa. In some cases it is found thickened; and the underlying inner fibrous coat is infiltrated and thickened with inflammatory cellular exudates. Indeed, all the tissues of the bronchi are infiltrated and thickened with inflammatory

products as in acute bronchitis, but the structural changes are greater and more permanent.

The matter of the basement membrane and its impermeability by cell elements is one of much importance. If, as contended by Hamilton, these elements are incapable of passing through it, and thus escaping from the free surface of the bronchi, they must pass in the other direction—into the peribronchial tissue—into the lymph courses and the interstitial connective lung tissue; and it is believed that the serious consequences, the obstinacy of the disease and its extension to other tissues are due to this fact. The effect of this membrane in these cases seems to be much like that of a firm fascia in determining the direction that pus in an abscess will pursue.

The swelling of the walls of the bronchi in these chronic cases is very great, and is due to hyperæmia, to accumulations and exudations of leucocytes, to embryonic cell proliferations, to serous and fibrous infiltrations, to engorgement of lymphatics, and to hyperplasia of tissues. The cell elements, which accumulate first in the inner fibrous coat, are about the size of leucocytes, and appear to have an active amœboid movement. They run in lines to the spaces between the cartilages and glands, and pass on, infiltrating the outer fibrous coat, and often ultimately extend farther. The muscular coat of the small arteries is thickened, and the capillary vessels much distended; and much dilated lymphatic vessels are also seen.

The *muscular coat* of the bronchi is variously affected in different cases. In acute bronchitis the only change observed was the cellular infiltration which took place between its fibres. In chronic cases, however, other changes occur. In some the pressure of the exudates between the fibres, and other causes produce atrophy of this coat; and then the pressure of air within the cavity of the bronchi, in the dyspnœa and coughing which accompany the disease, causes distention of the tubes, sometimes to a great extent. In other cases, this same pressure from the air is resisted by the muscular coat; and when its nutrition is not interfered with by the pressure of exudates or other causes, it becomes hypertrophied by the extra exertion it is called upon to make; and while the walls of the bronchi are thickened, their calibre is sometimes diminished.

The cell infiltration in the *outer fibrous* coat effects in it different changes; sometimes it is rendered invisible by atrophy or degeneration of its structure, or by the cell elements so freely poured into it, and by their multiplication and still other changes. The cellular infiltration extends often to the perivascular fibrous structure, and here the endothelial cells germinate, producing increase of fibrous tissue. This is continued often throughout the lungs to the pleural surface.

The *cartilages* in the bronchial walls undergo changes, the most frequent being that of absorption and atrophy, apparently from pressure; and their spaces are occupied by cell elements undergoing various changes. The destruction of these bronchial cartilages favors the bronchial dilatations, and the formation of bronchiectatic cavities soon to be noticed.

The *mucous glands* are always abnormal in this form of chronic bronchitis following the acute. Little abscesses not unfrequently form in them in acute cases, affording some of the purulent expectoration. In chronic cases there is often destruction of their stroma, it being replaced by embryonic cell tissue. Mucous accumulations dilate the ducts; and the cells within the sac are nearly all transitional. In some cases the gland is completely destroyed.

The middle-sized branches of the *pulmonary artery* in chronic bronchitis are not uncommonly atheromatous; and this has been noticed in connection with fatty degeneration of the heart, but may or may not be dependent upon it.

In chronic bronchitis following *valvular lesions of the heart*, the conditions are somewhat modified. Mitral regurgitation, which more particularly causes congestion of the pulmonary vessels, frequently produces bronchitis, accompanied with slight and sometimes more severe hæmoptysis.

On post-mortem examination the leading feature in the appearance is intense hyperæmia, with numbers of punctiform hemorrhagic spots between the layers of the pleura. The mucous membrane of the bronchi has a deep cyanotic tint, is thrown into folds by the intense distention of its vessels, and throughout the lung there are obscurely defined brownish-red patches of so-called "brown induration." They are hard, comparatively non-vesicular, and dry. Often also at the same time there are wedge-shaped hemorrhagic infarctions near the periphery of the lungs, their borders sharply defined and their base toward the pleura. These masses are hard, non-vesicular, and sink in water.

The mucous surface of the bronchi is denuded of its columnar epithelium, the basement membrane is œdematous, the capillaries of their walls are not only dilated but often ruptured; and while there is more vascular dilatation, hemorrhage, and œdema, there is less cellular infiltration and tissue change than in the ordinary forms of chronic bronchitis.

While the sputa are more likely to be bloody, they contain fewer mucous cells and more mucine and serum.

In short, there is more of a congestive and less of an inflammatory condition of the bronchi; and the desquamation of the columnar

epithelium is chiefly mechanical and due to the œdema of the basement membrane.

The Chronic Bronchitis due to the Inhalation of Foreign Matter, especially to the inhalation of coal dust, has been carefully studied by Mr. Hamilton, and he alleges that the coal dust obtains access to the lungs, not through the mucous membrane of the larger bronchial tubes, which are protected by the impervious basement membrane, but only through the alveoli and the minute bronchi. Most of the pigment is about the pulmonary arteries, outside of the bronchi. The deeper layer of the pleura and the lobular septa of the lungs are highly pigmented in those who suffer from the inhalation of coal dust.

“The parts which become pigmented in spurious melanosis are the air vesicles, the adventitious coats of the arteries, the lobular septa, the deep layer of the pleura, the outer part of the adventitious coat of the bronchus, and ultimately, the bronchial glands.” (Hamilton.)

The lymphatics are also injected and obstructed, and this contributes to the production of the œdema and inflammation. The interstitial fibrous tissue of the lungs, and especially the loose fibrous tissue of the mucous membrane, is kept in constant irritation, the deeper layers germinating and usually being shed long before they have completed their full development into proper epithelial cells.

To quote again Mr. Hamilton: “The immediate cause of the bronchitis is undoubtedly this epithelial germination, but the remote cause is to be sought in the impediment to the blood—vascular and lymphatic circulations from pigment deposits inducing an œdematous state of the bronchial mucous membrane, and consequently unfitting it for the growth of a proper epithelial covering.”

The sputa, in these cases of bronchitis, are of a yellow color, and this is from the abortive epithelial cells which they contain—mucopurulent or catarrhal.

The Chronic Bronchitis connected with Bright's Disease or the *gouty kidney*—an association very common, arising probably from the irritation of urea in the tissues, and the general dropsical tendency and consequent œdema of the bronchial membrane—presents no very distinctive anatomical features. Œdema of the membrane, epithelial desquamation, etc., are present as in other cases.

More hypertrophy of the muscular coats of the small arteries has been noticed than in ordinary cases; but this is a condition which is not peculiar to these arteries in diseases of the kidney. This will be referred to in connection with diseases of the kidney.

As has already been intimated, *chronic interstitial pneumonia* is not an unfrequent complication of bronchitis, and is often dependent upon it. This subject will be considered in another connection, and then the relations of bronchitis to pneumonia and phthisis will be discussed; and one object in view, in dwelling at such length upon the pathology of bronchitis, has been to trace the causative influence of this upon these other pulmonary affections.

The influence of bronchitis upon the lymphatic system of the lungs is of great interest, having important relations to the production of lymphoid deposits in the small lymphatic glands around the bronchi, and their subsequent transformation into other diseased conditions. The discussion of this subject will also be deferred.

Chronic bronchitis has important causative relations to *vesicular emphysema* and *collapse of the lung*; but a more full account of this will also be postponed until diseases of the lung substance are considered.

The subject of bronchial dilatation has already been alluded to, and as this condition belongs particularly to morbid conditions of the bronchi, its pathology requires some further consideration in this connection.

Bronchiectasy, as this special subject is called, has been a matter of much theoretic discussion—different explanations having been given to the phenomena by different authors.

These dilated bronchiectatic cavities are of different forms. Some are cylindrical—a lengthened portion of a bronchus being nearly uniformly dilated; others are globular, or nearly so; while others are mixed and irregular in form.

These cavities, recognized as bronchial since the time of Laennec, are found in connection with somewhat different pathological states.

It has already been shown that when inflammation of the bronchial tubes occurs, of such a form as to cause atrophy of the muscular coat and of the cartilages, and consequent softening and weakness of the walls, forcible breathing and cough, by the pressure of the air, will dilate the bronchi thus affected. This is one cause of bronchiectasis.

In interstitial pneumonia, with bands of false membrane extending in different directions between bronchial tubes, and afterward contracting, as is the law of false membrane, there will be a tendency to draw upon the walls of the bronchi in different directions, and thus distort them and cause irregular enlargements of their calibre. When there is contraction and collapse of a portion of the

lung tissue, especially when a rigid condition of the walls of the chest prevents a ready accommodation of its cavity to the diminished bulk of the lung, the inflamed, softened, and yielding bronchi may offer a more ready means of compensation, and yield more easily to the pressure of the air than the air vesicles, and, instead of emphysema, bronchiectatic cavities result. These may be at a distance from the collapsed portion ; but, in other cases, a bronchus may be obstructed at a certain point by accumulated secretion. The air vesicles supplied by it will collapse, and thus a tendency to a limited vacuum will be formed, which may be filled by dilatation of the weakened bronchus above the obstruction. In this case the enlarged bronchus is generally club-shaped—the enlargement greatest at the closed extremity.

In a portion of lung containing bronchial dilatations, transversely cut, numbers of pointed cavities will be seen with irregular margins, and projected into these cavities will often be found peninsulas of the bronchial wall which had not been retracted, some of them having a club-shaped appearance. The walls of these cavities are often highly congested, and loops of distended vessels are perceptible in them. The basement membrane, however, is intact, its elasticity allowing of its being stretched ; and this gives the cavities a smooth appearance. A layer of epithelial cells is upon the surface of this membrane, and these cells are usually more or less transitional in character ; but sometimes fully developed, typical, columnar, and ciliated epithelium will be found, especially in those cavities where there is much retained catarrhal secretion. This secretion has usually a pultaceous appearance, and is found to consist of common catarrhal matter, with numbers of shed columnar cells undergoing fatty and other forms of degeneration. The air vesicles connected with such a bronchus are often filled with secretion, either produced within them or gravitating from the cavity. The retained secretion of the cavity is sometimes thick and cheese-like, though this is not common. The lymph glands around these dilated bronchi are often much enlarged from inflammatory infiltration.

In reviewing, then, the causes of bronchial dilatation, it is found that this condition may be induced : 1. By forced expiratory and inspiratory efforts, as in the cough and dyspnoea of bronchitis, when the walls of the bronchi are weakened by the atrophied or softened condition of the muscular coat and the cartilages. 2. By the traction of exterior cicatricial tissue on the walls of the bronchi. 3. By inspiratory pressure when there is collapse of the lung elsewhere ; and 4. By obstruction of a terminal bronchus by the accumulation of catarrhal products.

We are now prepared to consider the *symptoms, course, and treatment* of this very common disease, bronchitis, in its different forms—acute, capillary, chronic, etc.

ACUTE COMMON BRONCHITIS.

ACUTE CATARRHIAL INFLAMMATION OF THE LOWER PART OF THE TRACHEA AND THE LARGER AND MEDIUM-SIZED BRONCHI.

Etiology.—This disease is usually the result of exposure to cold and dampness, though it sometimes seems to be dependent upon some general or more local zymotic influences, and in some cases is hardly distinguishable from influenza, which has already been discussed.

Conditions of climate have much effect upon the prevalence of this disease. It is much more prevalent in humid, changeable, and cold, than in dry, uniform, and warm climates. Humidity and variable-ness have much more effect than low temperature. Indeed, in some uniformly low temperatures, where the atmosphere is dry, there is a remarkable exemption from bronchitis. Seasons have an influence, and spring and fall are more unfavorable. A lowered state of general health predisposes to attacks, and in the extremes of life, infancy and old age, the disease is not only more severe and dangerous, but more common. The inhalation of dust and various gases may excite it, and minute organisms and the pollen of plants must be regarded as among its causes. Valvular diseases of the heart, which cause congestion of the pulmonary vessels, are very apt to cause bronchial as well as peculiar pulmonary inflammations.

It often commences with the symptoms of a common coryza—with feelings of chilliness, with some pain in the head and back, a sense of fullness in the region of the frontal sinuses, with congestion and irritation of the nostrils and throat, some degree of hoarseness, together with a moderate degree of fever and the accompanying conditions which it involves.

At first there may be sneezing and a dry state of the Schneiderian membrane and the membrane of the throat; but soon a secretion will commence, watery at first, but in a day or so becoming mucous and thicker. While these symptoms, which will be recognized as those of a severe coryza, are going on, a feeling of soreness, and often of pain, will be felt beneath the sternum, and more or less throughout the chest. A cough will now come on, dry perhaps at first, somewhat paroxysmal, sometimes ringing and at others stuffy, but soon followed by expectoration. This at first may be somewhat thin and watery; but

generally, or soon, it is distinctly mucous, glairy, and tenacious, becoming in a few days, in rather severe cases, more yellow or greenish, or sometimes brownish, and occasionally, especially if the cough is very severe, streaked with blood.

In other cases the symptoms of coryza do not precede or accompany the attack. The disease is confined mostly to the larger and medium-sized bronchi, but is accompanied with general symptoms similar to those just mentioned. The patient, if strong and vigorous, may not be disposed to take his bed ; but in most persons, in decided cases, the feeling of illness is sufficient to induce quietness and the recumbent posture. The fever will vary, but seldom exceeds 102° or 103° F. at most, and may be much less. It is commonly from 100° to 101° F. As the disease goes on, the expectoration, in the earlier stages mostly transparent mucus, becomes more opaque, yellow, and purulent, and is sometimes nearly pure pus. The cough is commonly the most troublesome symptom, though the dyspnoea is sometimes marked. The amount of expectoration varies much. It may be very abundant or almost absent ; but in the latter case the irritation of the membrane may be so great as to cause a very frequent ringing cough. In decided cases, as the mucous membrane is denuded of its columnar and ciliated epithelium, the mucus is not quietly brought up by the action of cilia, and is only raised by coughing, or by forcible expirations in the act of vomiting.

The course and continuance of the disease are variable. It has no definite period of self-limitation—is not as much inclined to observe periods as croupous pneumonia ; and yet in ordinary cases it usually subsides in the course of from one to three weeks. It is probably the case that when the inflammatory action is confined chiefly to the surface of the bronchi, not involving to any considerable extent the parts beneath the basement membrane, and when the exciting cause is removed, the inflammation soon runs its course, and resolution and recovery early occur. When, however, the inflammation extends to the deeper parts—to the muscular and fibrous coats—for the anatomical reasons already given, the inflammation is apt to linger, and it not unfrequently becomes chronic, with the anatomical consequences which have been mentioned.

When the exudate is of a croupous character, as is sometimes the case, the disease is more severe than in the ordinary simple catarrhal cases.

Death directly from simple catarrh, when confined to the larger and medium-sized tubes, occurs as a rule only in feeble and debilitated persons, in young children, or in the aged. It may, however, lead to other diseases, as has been so fully explained, and is therefore a disease of importance.

CAPILLARY BRONCHITIS.

Pathological Phenomena.—When the inflammation extends to the capillary tubes, or when, as sometimes is the case, it commences in that locality, the disease is much more severe, and in children especially is exceedingly dangerous. The swelling and exudate more readily close up these minute tubes, and as the disease when idiopathic is always bilateral, and affects more or less all the tubes of a similar size, the dyspnœa becomes very great, and the danger of cyanosis and slow asphyxia is imminent. The lung substance—the air vesicles—may remain free; but they also are often involved, producing a complication of catarrhal pneumonia. The danger then is, of course, increased.

When the air vesicles remain free, by the forcible inspiratory efforts of dyspnœa, the air passes in through the restricted tubes more freely than it passes out, and the consequence is an emphysematous distention of many of the vesicles. If, however, there is complete closure of any of the bronchi, the air will be absorbed from the alveoli connected with the closed tubes and their collapse will follow. Some of the vesicles, therefore, will be distended, while others are collapsed.

When the inflammation involves the alveoli, and bronchopneumonia results—a condition not unfrequent in children—it is usually lobular, some scattered lobules being involved while others escape. This congestion and distention of some parts, and freedom from disease of others, gives, on *post-mortem* examination, an irregular and mottled appearance.

Symptoms.—The symptoms of capillary bronchitis are marked and severe. In addition to those general febrile and other symptoms common to all forms of acute bronchitis, there will be great dyspnœa, often paroxysmally exaggerated, but constantly decided, with a cyanotic condition often coming on rapidly. The circulation of the blood through the lungs, and consequently through the heart, will be obstructed, and a general congested condition of the venous system follows. The countenance is livid, but the ground tint, unlike that of croupous pneumonia, is pale. There is not the same condition of arterial injection, and not the same redness as in pneumonia.

The cough and expectoration are variable. Until sensibility is diminished by the narcotism of carbonic acid from the obstructed respiration, the cough is generally frequent, and the expectoration, when there is much cough, is commonly more free. Later the cough may almost entirely cease, when the danger will be enhanced by the accumulations of excretions.

The febrile reaction is often feeble, the pulse weak, but as depression goes on it often becomes very rapid; the temperature will often be elevated, as in other cases of bronchitis, in the internal parts, but from the deficiency of circulation the temperature of the extremities and of exposed parts often becomes low. Occasionally the temperature of the whole body is below the normal. From the obstructed circulation of blood, and distention of the right side of the heart, the liver becomes passively congested, and is sometimes much distended and enlarged, so as to be distinctly felt some distance below the ribs. The hands and feet become swollen and flabby, and a clammy sweat sometimes becomes general.

The countenance, unless a comatose state supervenes, is anxious and expressive in severe cases of suffering from suffocation; and in these cases, if expectoration fails, death commonly soon follows from apnoea and depression.

Diagnosis.—The diagnosis of bronchitis is to be made by observing the symptoms detailed, by examining the sputa, and by the physical signs. In common bronchitis the expectoration is mucous or muco-purulent. It is rarely fibrinous or plastic, though commonly abundantly corpuscular. The mucus is generally, from its tenacity, aerated and floats on water. When not thus bubbling it is heavy as pus and sinks.

When examined microscopically the sputa of bronchitis are found to consist of, 1st. Aborted epithelium, that is, of mucous corpuscles. 2d. Mature epithelium—columnar and ciliated—sometimes undergoing fatty degeneration. In the latter stages of severe cases the columnar epithelium is apt to greatly diminish or entirely disappear. 3d. Granule cells or molecules. 4th. Pus cells. Often the epithelial cells, under a severer grade of inflammation, are transformed into pus cells. They are sometimes very abundant, especially when little abscesses form in the mucous glands. 5th. Blood corpuscles sometimes, generally in streaks from rupture of the basement membrane. 6th. Rarely fibrinous material with large numbers of corpuscles, forming plastic inflammatory exudate—the expectoration then being often in flakes or casts of tubes. 7th. Fat granules or globules. 8th. Chloride of sodium and phosphate of potash. 9th. There may be foreign substances inhaled or derived from the food. Mucine is to be detected chemically rather than microscopically.

In tuberculosis the peculiar tubercle cells and other tuberculous matters are often found in the sputum, but not in simple bronchitis; and when the pulmonary tissue is broken down, fragments of it will be found—air-cells, small bronchial tubes, blood-vessels, lymphatics, etc. These, of course, are not found in simple bronchitis. In chronic

bronchitis, and especially where sputum is retained in dilated bronchi, offensive expectoration is sometimes thrown up containing butyric and acetic acids.

It is sometimes an object to determine whether the sputa in bronchitis are fibrinous in character, indicating a croupous form of inflammation, or whether they are simply catarrhal. The form the sputum takes and its simple appearance are not conclusive. Fibrine and mucine, when treated with dilute acetic acid, are differently affected—fibrine swells up and becomes more bulky, while mucine shrinks and becomes more firm. In well-marked cases, says Niemeyer, "error is impossible."

The *physical signs*, positive and negative, in bronchitis, are of importance in making the diagnosis. In *ordinary acute bronchitis*, on *inspection*, the statical state is normal, the symmetry is good. The dynamical state or motion may also be normal. If there be dyspnoea, the respiratory movements, and especially the inspiratory, will generally be more rapid. The respiration, however, is more inclined to be labored than panting, and each respiratory effort may be prolonged. On *palpation* the vocal fremitus is increased when the voice is hoarse, but it is increased alike on the two sides, and not exclusively in any special part of the chest.

A rhonchal fremitus is sometimes felt, especially in children, from the air passing through abundant mucus in the bronchi.

Percussion, as a rule, is negative. There may, however, be some dullness when the tubes are greatly loaded; but then it will be alike on the two sides, and there will not be the advantage of comparison and contrast, and generally the distention of the air-cells, which is likely to occur when there is dyspnoea, from the more forcible inspiratory and less forcible expiratory efforts, counterbalances the increased amount of matter from the swelling of the tubes and the accumulations within them. When, however, particular tubes are completely obstructed, and portions of the lung collapsed, or when, from gravitation, the air vesicles are filled with the bronchial secretion, there may be local dullness. All these cases, however, are exceptional.

On *auscultation*, the vesicular murmur may be natural or nearly so, or it may be somewhat irregular, deficient, or feebler in some points and puerile in others. This will depend upon the absence or presence of bronchial obstruction, or accumulations by gravitation of secretions in the air vesicles. When obstruction of a bronchus occurs, the air will not pass into the vesicles connected with it, and if it be a bronchus of much size the respiratory murmur will be absent in a local part, or, if the obstruction be partial, it will be feeble in that part. The parts near by, however, from the comparatively unob-

structed movements of the chest, will receive more air, and there the expiratory sound will be exaggerated—puerile. In most cases the respiratory murmur is somewhat harsher than normal throughout the chest, and in severe cases it is feebler.

But the most positive signs are the adventitious sounds, the *râles*. These are not always present. The swelling of the bronchial tubes may be so uniform, they may be so free from the accumulation of secretion, or it may be so evenly distributed, that there will be no irregularities in the calibre or lumen of the branch sufficient to produce râles. Generally, however, at least in severe cases, they are heard. In the first stage, when the membrane is comparatively dry, or whenever the swelling or the tenacious mucus produces marked narrowing of the lumen of the bronchi in points, the dry, musical, or whistling sounds will be heard, sonorous or low-pitched if in the larger tubes, and sibilant or high-pitched if in the smaller. Whenever the secretion is sufficiently free and sufficiently liquid to produce bubbling as the air passes through it, moist or bubbling râles will be heard. Generally, in acute and severe cases, the two are mingled. They are, however, all fugacious. Dependent, for the most part, upon the presence of accumulations which are movable in the bronchi, by cough or a full inspiration they change their position. The sounds are consequently changing, sometimes heard and sometimes not, in the same point. These sounds, however, must be taken with other conditions. The tenacious sputa from pneumonia, while passing along the bronchi, may produce the dry sounds, and the more liquid exudates, in the latter stage of the disease, may give moist ones. In hemorrhage from the lungs moist râles may be produced, and in asthma the dry sounds are generally abundant. Sometimes crepitations are heard, especially if mucus gravitates into the air-cells.

The physical signs of capillary bronchitis are more definite and characteristic. Besides those of ordinary bronchitis, which are often present, the *subcrepitant râle* is heard. When it occurs—generally over the chest, and quite purely at the bottom of both lungs—it is an evidence of fluid and partial obstruction in the capillary tubes, and when taken in connection with the symptoms of capillary bronchitis already described, it is quite pathognomonic of the disease.

Bronchitis is to be distinguished from asthma and emphysema (with which affections, however, it is often combined), from pneumonia, and from measles. From measles and other eruptive fevers it is to be distinguished by the manner of attack, and by the eruption; and with the other diseases a comparison will be readily made after they have been described.

Prognosis.—The prognosis in capillary bronchitis, as already

intimated, is very grave. Death is sometimes speedy, though more commonly it occurs from the fifth or sixth to the twelfth day. Some cases are very mild, and terminate in resolution in a week or two—or even earlier. Though so often fatal, yet even in severe cases there is sometimes great tenacity of life, and recovery takes place after the most extreme symptoms.

There should, therefore, be perseverance in efforts to save life.

TREATMENT OF COMMON ACUTE BRONCHITIS.

It is important to arrest a bronchial inflammation as early as possible. The longer it continues, the more likely are the deep tissues to become seriously involved, the more difficult is the cure, and the greater the danger that the disease will extend to the lung connective tissue, the alveoli, and the lymphatic vessels and glands. In many cases of coryza extending downward and threatening bronchitis, a large Dover's powder, or a full dose of morphine with a grain or two of ipecacuanha, promptly given, and at the same time a foot-bath or a general warm bath, together with warm drinks—the opiate repeated once or twice if necessary—will often arrest the disease, or, at least, prevent its extending to the bronchi. A free dose of quinine—from six to ten grains, repeated twice or thrice—combined with the effects of an opiate, is still more certain to arrest the disease. Salicine, salicylic acid, or salicylate of soda, is perhaps equally effectual, though my own experience with these articles in bronchitis has been very limited, from the fact of my being so well satisfied with the action of quinine and opiates. The powerful diaphoretic and sialagogue effect of jaborandi, or its active principle, pilocarpin, is suggested, and I cannot doubt that in some cases it may be very effectual, and not unsafe. Some hours after this treatment, whichever of the articles above mentioned be selected, a saline cathartic as a rule should be given. Sinapisms and fomentations, or water-dressings to the chest, may aid the effect of the other treatment, and in severe cases should be used.

The same treatment will often be successful, and is indicated when the primary attack is upon the bronchial membrane, or when the inflammation has extended from the upper air passages, and has become established in the bronchi. The earlier this treatment is used, however, the more likely is it to prove effective. Decided antipyretic doses of quinine usually abate the severity of the disease, if they do not arrest it, at whatever stage they are given. They are, therefore, generally indicated. A decided antipyretic impression should be made at least once. Opiates should be used with more

care in the advanced stages of severe cases, when the mucous membrane has become denuded of its epithelium, when a free secretion is present, and when expectoration depends upon the cough. Then opiates, given to the extent of arresting the cough, may lead to dangerous accumulations of sputum. There is danger of this with children especially. Still, if the secretion be not great, while the cough is dry and frequent—and more than is necessary for the purposes of expectoration—the opiate in some form, generally in combination with some expectorant, is decidedly useful. Other anodyne or narcotic substances may be substituted where opium disagrees. A combination of bromide of potassium with an opiate in an expectorant mixture, or preparations of conium, hyoseyamus, etc., may be used.

In the mild cases the simplest means, or no special means at all, will be required—these cases generally terminating spontaneously in resolution in a few days.

When a bronchitis is well established, and in some cases however early given, the abortive means described fail to arrest the disease. Then other measures will be required. What is commonly called a mild “antiphlogistic course” is usually resorted to. This consists in the use of sedative expectorants, diaphoretics, laxatives, and diuretics, often alkalies, with counter-irritation, and perhaps cupping to the chest, and the inhalation of steam to which anodyne substances are often added.

The particular means for carrying out this plan of treatment are various. Tartarized antimony, formerly in great favor, but afterward, during the prevalence of the views of Todd and Bennett, falling under the ban of professional disapproval, is again coming into favor, and is quite the common remedy in Paris, and in some other places, for bronchitis, and in different forms of inflammatory and febrile affections. The human constitution and its ordinary diseases have not materially changed, and tartar emetic is the same as in the days of Laennec, when it was so highly recommended; or as in the time of the brief surgeon-generalship of Hammond, when its use in whatever conditions was officially forbidden in the United States army. It has the same virtues and dangers now as ever, and may be useful or injurious in bronchitis, according to the manner of its use and its adaptation to particular cases. It is a sedative, depressing, and spanæmic agent, and a local irritant to the mucous surface of the stomach and bowels. When given in free doses, long continued, to feeble and anæmic patients, or where there is a tendency to gastric and intestinal irritation, it can scarcely fail to do harm—often very serious harm. On the other hand, a vigorous and well-nourished subject, with no morbid irritability of the gastric membrane, may take it in

proper medicinal quantities without injury, and often with benefit, in relieving inflammatory action, promoting expectoration and perspiration, and abating feverish excitement. It may operate also beneficially in promoting absorption of the inflammatory exudates from the deeper tissues of the bronchi, and may tend to prevent the extension of the inflammation to the lung tissue. Experience seems to have confirmed its utility in many cases of acute bronchitis, and under proper restrictions it may be given with propriety and advantage. Dr. Walsh advises it in doses of from $\frac{1}{2}$ to $\frac{1}{8}$ of a grain, repeated once in a few hours, and there is much testimony in favor of its use. Ipecacuanha has a somewhat similar but less powerful effect, and is much safer in feeble subjects. In doses sufficient to produce slight nausea it often gives marked relief; and in children particularly, given in divided doses, and occasionally carried to the extent of vomiting, it is often especially useful—particularly when the cough is suppressed by the patient in consequence of the pain it gives, and where, from the destruction of the ciliated epithelium, expectoration is interfered with, and the secretions in the bronchi accumulate. In these conditions the vomiting is essential; and it is fortunate that the act of emesis in children is, from the shape of the stomach, more readily effected and much less distressing than in adults.

Lobelia is another article in favor with some. It causes a more free and watery secretion from the surface of the air passages, and thus promotes expectoration by rendering the mucus less tenacious. It is, moreover, relaxing and antispasmodic. But it is depressing to the nervous system in its immediate action, and the nausea it produces is distressing. In some cases, however, a lobelia emetic (and it may be preceded or followed with advantage by some warm infusion, as of ginger or capsicum) will afford very great relief. It is not spanæmic like antimony, and its depressing effect is comparatively temporary. It has, then, its range of applicability in acute bronchitis.

Tincture of aconite or of veratrum viride may answer a useful purpose; but excepting in severe cases with much fever these articles should not be carried to much extent.

Alkalies, especially when the sputa are tenacious, and salines are frequently useful. The hydrochlorate of ammonia, with small doses of tartar emetic, in a liquorice mixture, is often useful.

The carbonate of ammonia, especially where there is depression, is often indicated; and the acetate of potash is often used; and particularly the chlorate of potash is justly held in estimation. The latter is one of the most frequent remedies prescribed in moderate cases. It should be given to the extent of a drachm or something more in the twenty-four hours in divided doses, in solution, freely

diluted. Lozenges of this article are in common use for "colds" and sore throats. It is useful in various mucous inflammations. Much has been said of late of its irritating and poisonous effects in over-doses, and it is certainly capable of such effects when large quantities are given. In the doses mentioned it seldom produces any injurious effects.

There are different mixtures, such as syrup of squills, sweet spts. nitre, and paregoric, etc., which are often prescribed. Compounds of the wine of antimony, syrup of ipecacuanha, of senega, etc., are often used. They are palliative at least, and may aid in cutting short the disease.*

In some severe cases, especially in old persons, when the sputa are tenacious, the cough spasmodic, but feeble and inefficient in expelling the accumulations, the breathing difficult, and the depression marked, I have found that an emulsion of asafoetida and carbonate of potash promotes expectoration, relieves the difficult breathing, and revives the fast failing strength of the patient. This emulsion is

* Specimen formulas :

℞ Carb. of Ammonia.....	3j
Fl. Ext. of Squills,	
" Senega.....	āā 3ij
Paregoric.....	3jss
Water.....	3j
Syrup of Tolu.....	3v

M.—Dose from three to four tea-spoonfuls, as may be required.

℞ Muriate of Ammonia.....	3ij
Ext. of Liquorice Pulv.....	3j
Mucilage of Gum Arabic,	
Water.....	āā 3iij

M.—Dose a table-spoonful every two or three hours.

℞ Iodide of Potassium.....	3ijss
Syrup of Tolu,	
Glycerine.....	āā 3ij
Sulph. Morphine.....	gr. j

M.—Dose a tea-spoonful once in four or six hours.

℞ Wine of Antimony,	
Fl. Ext. of Senega,	
Sweet Spts. of Nitre.....	āā 3j

M.—Dose one to two tea-spoonfuls, as required.

℞ Syrup of Ipecac.,	
" Squills,	
Paregoric,	
Sweet Spts. of Nitre.....	āā 3j

M.—From one to three tea-spoonfuls, as needed.

made by rubbing equal parts of the fetid gum and potash with sugar, and when thoroughly mixed and pulverized, adding water and rubbing into a smooth emulsion. Of this mixture a sufficient quantity should be given, so that from eight to twelve grains or more of each of the medicinal ingredients is taken at a dose once in from one to three hours.

Carbonate of ammonia in a mucilaginous vehicle in similar conditions is also useful, but not as efficient in promoting expectoration as the asafoetida mixture.

When there is much congestion of the brain from obstructed respiration and circulation through the heart, bleeding may be demanded. Ligation of the extremities, so as to retain blood in them, will answer a similar indication, and that, with free dry cupping, may be sufficient in some cases without the loss of blood. If the patient is not anæmic, and especially if plethoric, the abstraction of blood will be safe, and more efficient and permanent in its effects. When the temperature is high, there is reason to suspect that the inflammation has extended to the lung substance, and antipyretics may then be required.

Another important means for promoting expectoration and soothing the inflamed mucous surface is the inhalation of steam, or warm atomized fluid, either simple or variously medicated. A dry cough may be greatly relieved by inhalations of vapor in which are diffused opium or conium, hyoseyamus or belladonna extracts. In cases of children, and sometimes with others, a temporary tent made by blankets over the bed, in which the patient may be enveloped with steam, will be useful, or the air of the whole room may be saturated with vapor. The importance of emetics, especially in the case of children, when expectoration does not take place and the bronchial secretions accumulate, must not be overlooked.

The bowels should be kept open during the disease; and not unfrequently a decided saline cathartic in different stages of the disease will procure more relief than many other measures more commonly resorted to.

Where bronchitis lingers, and fears are entertained of the extension of disease to deeper parts, the iodide of potassium should be given in doses of from five to fifteen grains several times in a day. The efficacy of this remedy in modifying the exudates, and especially in relieving the engorgements and deposits in the lymphatic glandular tissues, so liable to become involved in protracted bronchitis, is now quite generally acknowledged. The importance of this remedy, particularly in lingering cases, should be specially emphasized.

In the subacute stages, in many cases, the *turpentine emulsion* will

often be very useful. Tea-spoonful doses of the usual mixture, once in from three to six hours, will often strikingly manifest its beneficial effects. I have sometimes added to the emulsion the iodide of potassium, obtaining a combined and very decided effect.

Benzoic acid, and the benzoate of soda, are remedies which have been suggested and used, but I can say little of them from my own experience.

The number of remedies which have been advised for the single disease of ordinary bronchitis may seem like an encouragement of "polypharmacy;" but these remedies are not all to be used in a single case; and the different conditions of constitution, age, particular states as to plethora or anæmia, strength or debility, and the stage, severity, and special tendency of the disease, are so various that no one remedy or particular course is always applicable, and the most skillful treatment consists in a proper selection from a variety of measures of that which is best adapted to each particular case.

TREATMENT OF CAPILLARY BRONCHITIS.

This form of disease, though so different in some of its phenomena, and so much more serious in its immediate consequences, involves general principles of treatment similar to those of the common bronchitis, an account of which has just been given. As this affection is so severe and dangerous, it should receive the most prompt attention, and should be broken up at once if possible. *Quinine should be given in antipyretic quantities, and its full effects promptly obtained.* In its absence salicine, salicylic acid, or the salicylate of soda, should be substituted. These latter articles produce less disturbance of the nervous system, as a rule, and may be given in larger doses than the quinine. Future experience may show them to be quite as efficient in these inflammations, as they have already been proved to be as antipyretics in typhoid and other fevers; and they are decidedly more efficient than quinine as antirheumatic remedies. But quinine has had a longer trial, and its effects in preventing or checking inflammatory processes, including exudations, are better established.

There must be more care in the use of opium, when the apnœa is decided, than in ordinary bronchitis. The reason of this caution is obvious. Opium lessens the disposition to cough, and checks the freedom of respiration, partly at least by diminishing the feeling of want of air. Still, a moderate quantity may generally be added to the quinine, without danger, at the early period of the disease.

Dry cups may be applied extensively, and in case of an adult in

a vigorous general condition, with the usual quantity of blood, and especially if there be plethora, a venesection will often afford prompt and efficient relief. Prof. Flint, who is far from being *sanguinary* in his practice, states that, on two occasions, he has experienced in his own person immediate and permanent relief from bleeding. (Flint's Clinical Medicine, p. 91.)

A poultice, or a warm-water pack with an impervious jacket over, should be applied to the chest, and steam should be inhaled at a temperature of 68° or 70° Fah. Perhaps the best method is to envelop the patient in the steam, under a canopy of blankets. Carbonate or hydrochlorate of ammonia, or the chlorate of potash, may be given; and when accumulations of secretions are abundant, emetics must be administered. In cases where much of the spasmodic element is present, the asafoetida mixture may be given; and in the extreme dyspnoea, when but a small volume of air can be taken, making it more rich with oxygen gas cannot fail to be useful. As death is by apnoea—from deficiency of oxygen—the inhalation of this gas may bridge over the chasm, sustaining life until the disease subsides.

When from the extent of the disease the patient suffers from shock and depression in addition to the dyspnoea, ether, ammonia, camphor, musk, or alcohol, may be tried, as in other cases of shock and depression. It should be remembered of alcohol that it is a narcotic, and tends to diminish respiration and aeration of the blood, and it must therefore be used with great caution.

The strength should be sustained as far as possible by nourishing food, and quinine in tonic doses will often in this last stage be useful. Egg-soup, beef-tea, milk, and farinaceous substances, etc., as the stomach will bear and can digest, should be given.

Oedema of the lungs may come on as a complication produced by the obstructed circulation and intense congestion. This may be distinguished by an increase of the dyspnoea, by a thinner and more watery expectoration, which often occurs, by the addition of a moist vesicular crepitation to the subcrepitant rhonchus, and by dullness on percussion. When this is a permanent feature, eliminatives, cathartics, and diaphoretics may be required, and digitalis will frequently fulfill a double indication: that of eliminating by the kidneys, and, what is more important, increasing the power of the heart to carry on the circulation, notwithstanding the obstruction.

The jaborandi, if the depression of the heart's action be not too great, will be applicable, and if borne by that organ will often diminish the oedematous condition rapidly.

Capillary bronchitis is more likely to occur in children than in adults, and then the treatment must be modified and adapted to their

age and condition. This will require discretion and judgment; but the same principles apply as in the case of adults.

Blood-letting by some seems to be thought scarcely admissible in the case of children, and it should doubtless be practiced with great caution in such cases; but a quantity of blood, proportional to its age and size, may be taken from a child with scarcely greater risk than from an adult. A free hemorrhage from the umbilical cord in the new-born child is often remarkably well borne, and surgical operations involving the loss of blood are often as well borne in children as in adults. In extreme cases risks must be run, and a vigorous child ought not to be allowed to die of extreme congestion of the lungs, and perhaps of the brain also, without an effort at relief by diminishing the quantity of blood, when the other means suggested have failed.

When inflammation occurs in the capillary tubes, from the very close proximity of the alveoli, and the comparative similarity of their free surface to that of those minute bronchi, it is apt to extend, especially in children, to many of the pulmonary lobules, constituting lobular or catarrhal pneumonia. There will then be a rise in temperature and a change in the physical signs; but this will be referred to in another connection. The treatment will not require to be materially changed, though the antipyretics will be still more strongly indicated.

Fibrinous bronchitis rarely, but still sometimes, occurs. Not unfrequently in plastic or true membranous croup, the same form of inflammation extends to the bronchial tubes, and casts of them have been removed *post mortem*, presenting the form of a widely branching tree.

But an inflammation attended by a similar plastic exudate may be confined to the bronchial tubes, constituting fibrinous bronchitis. This is a more severe and dangerous form of the disease, as the tubes are liable to become obstructed by this exudate, causing collapse of some portions of the lung and emphysema of others, or obstructing the breathing altogether and causing severe and fatal apnoea.

The general febrile symptoms will not differ materially from those of ordinary bronchitis, and the physical signs are such as may be caused by common or catarrhal bronchial inflammation. The only certain diagnostic condition is the expectoration of fibrinous casts of the bronchi, usually after severe fits of coughing. These fibrinous substances may be in short pieces or detached masses, or in long, branching casts of the bronchi. This form of bronchitis occurs more frequently in the young, but its special causes are not known. It sometimes assumes a chronic form, and is more or less continuous, while in other cases, repeated attacks occur with intervals of com-

parative or complete freedom from the disease. Generally in these recurrent cases some degree of bronchial or pulmonary disease is continuous.

The acute forms of this disease run their course rapidly, and about one half are reported as fatal. Death may take place in a very few days, and is seldom delayed over two weeks. The febrile symptoms are apt to be active; but the severity of the disease arises from the obstruction of the tubes and the apnoea. The cough is usually distressing, and hemorrhage sometimes complicates a case.

The chronic cases are apt to terminate unfavorably, especially as they are accompanied by other pulmonary lesions.

The treatment of these cases should be conducted on much the same principles as in other forms of bronchitis, presenting similar symptoms. Alkalies, iodides, and spanæmies will tend to make the exudate less plastic, and will be required. Inhalations and nauseants produce relaxation and a more liquid state of the exudates, and procure more or less relief. Emetics are important, and may aid in their expulsion. The general treatment should be much as in cases of membranous croup.

Cases of this kind, when not fatal, are apt to be protracted and to become chronic, the false membrane forming repeatedly. For these cases, and with reference to the removal of this form of inflammation, Prof. Flint says the iodide of potassium has been found especially useful. On general principles, mercury and various salines would also be suggested. The iodide is particularly indicated, and alone or in combination should be continued a long time.

Mild cases of bronchitis, or what are called "colds on the lungs," are of frequent occurrence, and in many persons are regarded as of little consequence; in a large proportion of cases these colds pass off, leaving no unpleasant effects behind. In other instances, especially where there is a tuberculous tendency, the results may be very different. When there is such a diathesis, the case should receive prompt attention, and should as speedily as possible be broken up. The same principles of treatment are applicable as in the severer forms, and some of the same measures already described should be put in operation. Not unfrequently a saline cathartic will quite speedily put an end to these mild cases, and the chlorate of potash is a common and favorite remedy.

A circumscribed bronchitis often occurs in phthisis, produced by the local irritation of the tubercular deposits. Opium in a few free doses, and more effectual still, quinine and opium, will seldom fail to check decidedly and promptly this form of acute bronchial inflammation.

In the cases of secondary bronchitis dependent upon disease of the kidneys or the heart, the primary affection must receive attention, while the means of combating the bronchitis will be similar to those described. When dependent upon chronic diseases they are apt to become chronic and obstinate.

The acute forms of secondary bronchitis dependent upon the eruptive and other fevers, influenza, diphtheria, etc., have already been discussed in connection with those affections.

CHRONIC BRONCHITIS.

Symptoms.—The morbid anatomy and pathology of chronic bronchitis have been sufficiently dwelt upon. Its symptomatic phenomena, diagnosis, and treatment remain to be noticed. Different symptomatic and etiological varieties were mentioned when its pathology was described. What is called a winter cough usually comes on in the autumn, sometimes abruptly, as from taking cold, but generally more gradually, with scarcely any or no perceptible fever, and with but slight feelings of illness. The cough may at first be dry, but there is usually expectoration of a glairy mucus, varying, however, in character and amount. The cough may cease during the night, or the patient may be disturbed by occasional paroxysms. A more severe “coughing spell” usually occurs in the morning, and continues until the accumulations which have taken place during sleep are expectorated. The general health and strength suffer more or less; and the patient is subject to more acute attacks on even slight exposures. This goes on during the cold and variable season; but when the more settled weather of advanced spring and summer comes, the cough subsides and nearly or quite disappears, to return perhaps in an aggravated form as winter approaches.

In other cases the cough continues the whole year, but is more severe during the colder season. In these less mild cases, the expectoration is apt to be more abundant, is often muco-purulent, and may be offensive in odor. In these cases there will be a slight elevation of temperature, often much difficulty of breathing, gradual emaciation and loss of strength, but the pulse will not be very rapid, and the morbid sensations of the patient are not extreme, though he is generally mentally depressed and more apprehensive of serious consequences than those who have tuberculous deposits.

In some cases the secretion and expectoration are very free, and more thin and watery, amounting to a bronchorrhœa. In others the cough may be almost dry—the expectoration being very scanty.

While these symptoms are continuing, the anatomical changes already described are taking place. The diseased action almost always extends to the deeper tissues of the tubes, and from them to the lymphatics and to the connective tissue of the lungs. The thickenings, atrophy, obstructions, dilatations, etc., of the tubes occur; and emphysematous distention of the air vesicles, collapse of some of the lobules, formations of nodular masses, and cheesy degenerations may take place; and in those at all inclined to tuberculosis, or who are placed under unfavorable hygienic conditions, tubercles are apt to be deposited and phthisis is developed.

In some cases a distinct and more general emphysema, with the marked "barrel-shaped" chest, is associated with bronchitis; and in others severe asthmatic attacks complicate the disease. In many cases more or less spasmodic breathing from time to time occurs.

The common and most marked symptoms of chronic bronchitis are a sense of uneasiness and often stricture in the chest, often muscular soreness from the cough, but seldom pain, at least of any degree of persistence. The cough is usually the most marked and troublesome symptom. The expectoration, as we have seen, varies in amount and character, but usually consists of a mingling of mucine, mucous corpuscles, and in the severer cases pus corpuscles; and sometimes streaks of blood, and rarely fibrinous flakes and casts are present. The sputa are generally aerated and swim; but if they contain no air-bubbles they sink in water.

If the expectoration is nearly pure pus, as sometimes is the case, it is not usually aerated, and it then sinks.

The intensity of the symptoms varies—the patient is often better and worse, and the disease may continue not only for months, but years. A termination in interstitial pneumonia, in cheesy degeneration, or in tubercular deposits and phthisis, is not uncommon. Recovery, however, frequently takes place in cases resulting from acute attacks, under proper medical, climatic, and hygienic treatment. The longer the continuance and the older the patient, the less prospect is there of recovery.

Diagnosis.—The diagnosis of chronic bronchitis is a matter of importance both with reference to prognosis and treatment. It is sometimes a matter of some difficulty to distinguish it from several other conditions which resemble it in some of their phenomena, and especially to distinguish the simple cases of bronchial inflammations from those in which the diseased action has extended to other parts and presents the complications which have been mentioned.

It is to be distinguished by a careful observation of the history

and symptoms which have been given, and by the physical signs now to be described.

On *Inspection*, if chronic bronchitis is not accompanied by emphysema, or by complete obstruction of any of the tubes and collapse of any portion of the lungs, the form and movements of the chest are normal, or at least not characteristic. The respiration is seldom increased in frequency, and the pulse and respiration ratio is usually normal or nearly so.

On *Percussion* the resonance sometimes varies, especially in the cases which are severe and protracted, and more particularly where emphysema, bronchial dilatations, interstitial pneumonia, pulmonary collapse, or the filling of air vesicles and consolidations have occurred. These conditions, however, may be regarded as complications, though they are the natural results of the disease. When the bronchitis is simple, the change in the percussion note is produced only by the extensive filling of the bronchial tubes with the secretions; and then, as the character of the sound is given chiefly by the air vesicles, the change is but slight. The greater distention of the alveoli, which is common in the disease, usually fully compensates for the increase of solid matter in the swelling of the bronchi, and the ordinary accumulations in them; and moreover, as both lungs and all parts are usually about equally affected, there is no opportunity for contrast, and therefore *percussion is commonly negative*. In patients confined to the recumbent posture, there is sometimes sufficient gravitation of the epithelia into the air vesicles to cause dullness on percussion on the posterior part of the chest. The observance of all the negative signs is important, as by them various other conditions are excluded.

Auscultation affords more positive signs. The vesicular respiration murmur is often diminished, is harsher in quality, variable at different points, and is sometimes, though rarely, suppressed, at least temporarily, in some places, from obstruction of the tubes by the inflammatory exudates. The bronchial râles, both the dry and the moist, if present, are similar to those heard in the acute form of the disease; but they are both frequently absent at the time of an examination. When, however, the expectoration has been suspended for some time, they will be heard, and in most cases a few examinations, if not the first, will be almost sure to detect them. Unlike what occurs in phthisis, they are heard over both lungs and equally, and in the lower part quite as frequently as in the upper, or even more so. These sounds may be dry or moist; and the dry may be sibilant or sonorous, and the moist small or large, according to the size of the tubes in which they are produced. When the bronchial walls

are dilated, blowing respiration, and, if largely distended, even cavernous sounds may be heard. When the bronchi are partly filled with fluid, gurgling may occur, as in the vomica of phthisis.

The vocal resonance, or voice sounds from the chest, in ordinary cases of simple bronchitis, are not materially changed from the normal; but when dilatation of the bronchi and consolidation of the parts around occur, bronchophony, or even pectoriloquy, may in some cases be distinguished. Then the percussion note may be slightly tympanitic. The distinguishing of these dilatations from the cavities of phthisis is not always easy; but a more particular account of them will soon be given.

Chronic bronchitis is to be distinguished from phthisis, from chronic pneumonia, from emphysema and asthma, from congestion of the lungs caused by heart disease, from a *nervous* cough, from disease of the larynx and other parts of the throat, and from a cough symptomatic with disease of the stomach. It is more likely to be confounded with chronic pneumonia and consumption than with other conditions, and a more particular comparison will be made when these subjects come to be discussed.

The symptomatology and physical signs of those forms of chronic bronchitis dependent upon the inhalation of foreign matters, and upon chronic interstitial nephritis, do not differ materially from those which have been described. Those cases arising from valvular diseases of the heart present some peculiarities which will be noticed when diseases of the latter organ come under consideration. When secondary diseases are to be treated, the primary affection on which they depend must always receive particular attention.

The variety dependent upon the inhalation of foreign substances will differ from others mainly in the cause which produces it; and in its treatment the main difference will consist in the prophylactic management—avoiding the special causes which have produced it. When large carbonaceous accumulations occur, as in “miner’s consumption,” the case is removed from the condition of simple bronchitis.

TREATMENT OF CHRONIC BRONCHITIS.

The treatment of chronic bronchitis is a matter of much importance, and of no little complexity and difficulty. Many of the principles of treatment already discussed as belonging to the more acute forms of the disease are applicable in this, but the structural changes which occur in these protracted cases cannot be speedily removed, and the abortive measures of treatment are excluded, or can have no such prompt effect. Besides, many of the articles which are in the list of

“expectorants,” and that have hitherto been recommended and used, are of very doubtful efficacy, and whatever remedies are used must have the element of time to render them successful. It would be far from the present purpose, however, to intimate that treatment in cases of this disease is of no value. On the contrary, though some resist all measures in effecting a complete cure, most cases can be materially benefited by treatment, and many, even in advanced stages, can be cured.

The therapeutical treatment may be divided into *local* and *general*. The local treatment consists in applications to the external surface of the chest, and of vaporous substances, by inhalation, to the surface of the bronchi.

Various forms of counter-irritation are thought to have an influence in abating inflammation of the bronchi. This seems by no means incredible when the well-known fact is borne in mind of the marked influence which cold and moisture upon the surface so often have in inducing congestion and inflammation of the mucous membrane. Blisters, pustulation with croton-oil, the application of a mixture of two or three parts of vinegar to one of oil of turpentine, freely applied so as to induce an eruption, or other irritating applications often seem to do good, and if well borne may be used. To be of much service they must be continued for some time.

Inhalations are often very useful, especially so when the inflammation is most superficial. Different articles are used for different particular purposes. Some to change the action by supercession, as a caustic or an astringent is applied to a chronically inflamed conjunctiva, or to the lower bowels in chronic dysentery; some to check profuse secretion; and others to encourage and facilitate expectoration; while others still are used to soothe irritation and quiet excitement.

For alterative effect the spray of a solution of nitrate of silver or sulphate of zinc, of creosote or carbolic acid, or oil of turpentine, or the fumes of iodine, are applied. When used with discretion, the effects carefully observed, and the strength and frequency of the application adapted to each particular case, much benefit is sometimes obtained from these applications. When, however, these measures are used roughly and indiscriminately, more mischief than good is frequently realized. If the irritation, soreness, cough, etc., are increased for a period longer than a few hours, the application is too severe and must be used of less strength, for a shorter period at longer intervals, or discontinued entirely. If, on the other hand, in a short time after the application the symptoms are relieved, it may be repeated in one, two, or three days, according to the effect. Benzoate of sodium, carbolic and salicylic acids, and thymol are among the articles from

which selections are to be made. Perhaps of these none is more efficient than atomized carbolic acid.

The fumes of tar or turpentine, or benzoin, tinct. of tolu, or solutions of salicylic acid, are milder, and may be tried when the other articles produce too much irritation.

To check too profuse secretions, and at the same time to produce an alterative effect, solutions of tannin, alum, perchloride of iron, and other astringents may be used, similar precautions being taken to prevent excessive effects.

To promote secretion and expectoration, as well as for their alterative effect, solutions of common salt or of muriate of ammonia may be employed.

When the inflammation is more active, or after an irritating application has been made, opiate inhalations, or inhalations of conium, cannabis indica, chloroform, or simple warm water, are useful. In some cases where the cough is very frequent, irritable, and unavailing, occasional moderate inhalations of chloroform—simply snuffing from a vial—will produce very great and sometimes quite permanent relief.

Prof. Flint says he has known but little benefit to arise from treatment of this kind; but it has been too much in the hands of advertising pretended specialists, who are ignorant of the principles of diagnosis and therapeutics, and who make routine applications to all comers without proper discrimination, and, of course, without the best success. Both from theoretic considerations and from experience, I cannot doubt the often good effects of treatment of this kind in chronic bronchitis, when these means are properly used. The strength of the solutions for inhalation will vary much according to the character of the disease and the impressibility of the patient. Commencing with weak preparations, their strength may be increased according to their effects. For example, twenty or twenty-five drops of creosote may be added to half a pint of hot water, and inhaled for a short time from a simple inhaler. Carbolic acid of the strength of one grain to an ounce of water may be inhaled by means of an atomizer; and other articles in a similar manner, increasing the strength and continuing the process as may be borne and required.

The *general treatment*, however, is of more importance. Standing in the front rank of general measures are proper hygienic management and climatic changes. Proper food—nourishing and easily digested—should be selected. The bowels should always be regulated if their functions are deranged; the stomach should be looked to and put in as good condition as possible, since irritation of this organ often affects the bronchi by sympathy; the functions of the kidneys and liver

should be inquired into, and if wrong, corrected if possible; in short, the general system should be placed in as good a condition as possible, as a prerequisite to success in treating this disease.

The matter of exposure requires care. General confinement to the house is by no means the best safeguard against taking cold. Proper and often free out-of-door exposure in suitable weather, with proper but not excessive clothing, and protecting the feet particularly from wet and cold, is far better, as a rule, than indoor confinement. Flannel or buckskin or chamois-skin underclothing, frequent bathing, at first with tepid, and after with colder water, followed by frictions to keep the skin active and accustom it to vicissitudes which are inevitable—all these and other hygienic and prophylactic measures are of the greatest importance.

But often the climate in which a patient is situated is so unfavorable that a change, especially during the unfavorable season, is demanded. A warm and comparatively uniform climate, where an outdoor life is possible and enjoyable, is generally best. As to the indications of moisture or dryness of the air, much will depend upon the state of the inflamed bronchi. Where there is much irritation and inflammation, a warm and moist locality is often best. In other conditions, especially where there is a relaxed and profusely secreting state, a dry climate is far better. Sometimes an elevated and interior situation will produce marked improvement. At other times a mild, uniform, sea-shore locality, such as the coast of Florida, will answer a good purpose. But it is often impossible, without trial, to determine with certainty the climate that will best agree with a given case. Indeed, at different stages of the same case, different climates may be required for the best effects. As a rule, a mild and uniform climate is the most favorable for this form of disease.

It will often be best to change the locality with the changing season, following the birds, perhaps, in their annual migrations to a warmer climate in winter, and farther north again in summer. In old habitual cases of "winter cough," resisting curative treatment, this palliative course may keep the chronic sufferer in comparative comfort.

I have at present in mind a clerical gentleman, who from a long course of bronchitis and its consequences was so prostrated that, in what was considered an almost hopeless condition, he was carried on his bed from his home in New Jersey to an Atlantic steamer, and who spends now his winters on the Riviera—at Nice, Mentone, or Cannes—and his summers in the Upper Engadine, in Switzerland, the highest inhabited region in Europe. Though he still has some cough and much dyspnoea from emphysema, collapse, previous interstitial pneu-

monia, fibrous bands, etc., he is in comparative health and vigor. The mass of patients have not the means for such a wandering life, and must be treated at home.

Chronic interstitial pneumonia so frequently complicates chronic bronchitis, and degenerative processes so often follow this, leading to phthisis—cheesy or tubercular—that the climate best for consumption will often be the best for this affection. This subject will be more fully discussed hereafter, when treating of phthisical conditions.

But in most cases of chronic bronchitis, internal medication may do much for relief, and often for cure.

A frequent, hard, and persistent cough—more than is required for the removal of the bronchial secretion—is a source not only of discomfort, but of aggravation to the inflammatory condition, and tends to increase and continue the disease. This often requires to be allayed. It may be among the first indications to soothe this irritation, and put the diseased parts in a condition of comparative rest. At the same time, in these chronic cases, important anatomical changes have taken place, as we have seen. Inflammatory exudates, cell proliferations, have occurred in the walls of the bronchi—in the fibrous and muscular structure outside of the basement membrane. The lymphatic glands and vessels have been engorged, swollen with exudations and hyperplasias, and obstructed. The diseased action has extended, more or less, to the connective tissue of the lung substance, and the lymphatic glands at the root of the lungs are congested and swollen. These morbid hyperplasias and exudates are organizing into more permanent morbid tissues. By their presence they press upon natural structures, causing atrophy and absorption of the muscular coat and the cartilages of the bronchi, and often irritating the nerves of respiration. These, and other pathological conditions which modern research has so clearly shown, should be borne in mind in determining the course of treatment. Mere “expectorants,” admitting the existence of such a specific class of remedies, can do little for this state of things. If we have any agents which tend to arrest such pathological processes, and remove such morbid products, they are clearly indicated. The agents which have most reputation for such purposes, and that are well known to have effect in analogous cases of external disease, are the preparations of *iodine*. The preparations of mercury in small doses have also effects of this kind, but there are drawbacks to their use in the danger of spanæmic and debilitating effects, when carried beyond a certain point, which cannot always be determined. The hydrochlorate of ammonia is another article that has a reputation for such purposes, which it probably deserves. The addition of small doses of tartarized anti-

mony, as in Eberlie's mixture,* in the more active forms of the inflammation, may be well. Chlorate of potash is still another remedy, which not only tends to allay this kind of morbid action and remove its results, but also improves the condition of the blood, and promotes healthy nutritive processes. The preparations of arsenic, perhaps, have an effect in the same general direction as these other articles. It is thought that arsenic is particularly useful in dry bronchitis. It may be combined with iodides, or with lacto-phosphate of lime. Sometimes the cod-liver oil, by modifying nutrition and promoting more healthy processes in low and cachectic states, tends to the same result. Quinine occasionally, in doses sufficient to check inflammatory action when more acute, is of much importance; and in tonic and perhaps alterative doses, continued for a longer period, and in anæmic cases combined with iron, it may aid materially in effecting improvement and a cure.

The elixir of phosphate of iron, quinine, and strychnia is one of the best tonic preparations, and the lacto-phosphate of lime is often applicable either alone or in combination. The hypophosphite, where there is a loss by suppuration, is also useful. A combination of extract of malt, cod-liver oil, and hypophosphites is often prescribed in old and debilitated cases, and with advantage. Among these means, each of which may be more applicable in particular cases than any of the others, none have seemed to me so frequently and decidedly efficacious as the salts of iodine. Their resolvent effects upon forming and imperfectly organized inflammatory products everywhere, and particularly in the lymphatic glandular system, cannot be questioned; and their pretty free and somewhat protracted use, in these cases, is very often followed by the most marked improvement and ultimate cure. A combination which I have long used, and I am sure very often with most decided beneficial effects, combining a soothing and expectorant with an alterative action, prepared with varying proportions of the ingredients adapted to particular cases, is something like the following:

℞	Syrup of Tolu,	
	Syrup of Ipecacuanha.....	āā ʒij
	Fl. Ext. Veratrum Viride.....	ʒj
	Iodide of Potassinm.....	ʒjv
	Sulph. Morphine.....	grs. iij
	M.	

The dose is a tea-spoonful, or about a drachm, in a drink of water or some tisane, three or four times a day. When the irritation of the bronchi is decided, and the cough very troublesome, these propor-

* ℞ Muriate of Ammonia, Ext. of Liquorice, āā ʒ ss; Tartar Emetic, gr. j; Hot Water, ʒ viij. M.—Dose ʒ iij, three or four times a day.

tions will not be far from right. If less so, or the anodyne or narcotic effect is more than is necessary, the quantity of morphine should be diminished, and sometimes very much; or, if it does not agree well with the system, other narcotics, as conium, hyoscyamus, or belladonna, may be substituted. If nausea is produced, as will sometimes be the case, the quantity of ipecac. and veratrum viride must be lessened, or these articles may be left out, and the syrup of tolu increased, or simple syrup, or syrup of liquorice, or some other excipient used. Sometimes the iodide of potassium will be well borne in much larger doses, and sometimes the dose will require to be lessened. Occasionally an idiosyncrasy is met with in which this article, in almost any dose, will produce severe salivating and other irritating effects. These cases are rare, but when they occur, other iodides may be tried, particularly the iodide of ammonium; and if similar effects are produced, the bromide of potassium may be substituted. This should be given in somewhat larger doses than the iodide, and less of the opiate will be needed when its soothing effects are added. The foregoing prescription and these specifications are given as specimens illustrative of the plan of treatment advised, but the details are to be modified according to the conditions present. The continued use of the iodide, however, often for many weeks, or even months, when well borne, but in the latter case in smaller doses—from two to five or six grains, three times a day—cannot be too strongly advised. The other remedies mentioned may be resorted to in cases where the results of this are not satisfactory, or where the iodide is not well borne—where, as in very rare cases, it induces emaciation. Its action in causing atrophy of healthy gland structures, formerly so much spoken of, is so exceedingly rare as not to be taken into the account in prescribing it in the ordinary doses.

Medicines by their protracted use sometimes lose their first effects, and alternations may be desirable. The hydrochlorate of ammonia, and often the chlorate of potash, may take the place for a time of the iodide, or may be permanently substituted for it. So of the other agents named.

The bowels should be kept open, and the condition of the stomach and other organs attended to during this treatment. If the opiate constipates the bowels, a laxative pill containing aloes, hyoscyamus, and nux vomica, already repeatedly recommended, may be given at night, and this, or other means to prevent constipation should not be neglected. The hygienic measures, and the local treatment referred to, will not interfere with this course. The inhalations, however, will do little toward removing the structural changes which occur in this disease.

The balsamic preparations have long had a reputation in chronic bronchial affections. In many cases they certainly do good. They appear to modify the condition of the mucous membrane more than that of the deeper parts, and in cases where the disease has not penetrated too deeply they are sometimes decidedly efficient. The balsam of copaiva has, perhaps, the most reputation ; but I have used more frequently the emulsion of the oil of turpentine, and have often found it to have very marked beneficial effects. In the subacute rather than the chronic stages it is most efficient. A combination of iodide of potassium or iodide of ammonium with the turpentine emulsion often produces excellent effects.

As a specimen :

R ^x Oil Turpentine	℥ss
Tinct. Opium	ʒiij
Pulv. Gum Acacia,	
Pulv. Sugar.....	āā ℥ss
Iodide of Potassium.....	ʒiij
Aqua Camphora	ʒiij

M. ft. Emulsion. Dose, tea-spoonful three or four times a day.

In the cases that are secondary, depending upon gout, rheumatism, kidney or liver disease, or malaria, etc., the proper treatment of these several conditions will be essential.

In old and feeble patients careful supporting measures will be required.

Acute bronchitis may supervene upon a chronic case, and great danger then sometimes exists. The acute attacks should receive prompt attention and be broken up speedily, if possible. The means recommended for the abortive treatment of other acute cases should not be neglected. Quinine in free doses, opiates, fomentations, counter-irritation, soothing inhalations, etc., will be demanded. If such attacks occur from taking cold, I fully agree with Dr. Bartholow in advising quinine and morphine (grs. xv-gr. ss) promptly given. Nothing is so efficient, as I have long observed and taught, in checking such acute inflammatory attacks. Supporting measures, stimulants, will often be required in these cases. The use of galvanism here has been advised as a means of stimulation. Stimulating expectorants, the asafoetida mixture, etc., as the disease advances, may be called for.

BRONCHIECTASIS.

The symptoms, diagnosis, and treatment of dilated bronchi require some further description. The causes, varieties, and pathology of bronchiectasis have already occupied sufficient space. The symptoms are those of obstinate bronchitis, of which it is a consequence and a part. There is cough, often severe; abundant, and sometimes offensive secretion and expectoration, dyspnoea, etc.; and not unfrequently a hectic fever, more than occurs in ordinary chronic bronchitis, the phenomena resembling phthisis. Even the *physical signs* may mislead, and great care is therefore required in diagnosis.

On *inspection* the statical condition may or may not show a deviation from the normal standard. The motion may or may not be changed.

On *palpation* the vocal fremitus is increased.

On *percussion* the resonance is variable. It may be amphoric or tympanitic on a small scale; possibly the cracked-metal sound may be developed, depending upon the position and size of the cavernous dilatations; or the percussion note may be dull or hard, depending upon the amount of consolidation around.

On *auscultation* bronchial respiration, blowing respiration, will generally be distinct, and often it will be cavernous like the sound heard over the trachea, and when fluid is present in the cavities, there will be gurgling or very coarse râles.

The vesicular murmur is less, or absent in some points, but may be puerile or loud and harsh in others.

The vocal resonance is increased, and it is often modified so as to be broncophonous or pectoriloquous. Râles, both moist and dry, will be heard in the bronchial tubes.

These signs do not distinguish bronchiectatic cavities from tubercular vomicae. The diagnosis must be made by obtaining the history of the case, by both sides being affected generally and simultaneously in bronchial dilatation, by its not being specially liable to begin above, and by the continued absence of fragments of lung tissue or of tuberculous matter in the sputa. The progress of the case; the frequent stationary character of the bronchial disease; the occasional more offensive character of the sputum, its less purely purulent character; the temperature, which in bronchitis, and particularly in its earlier history, is not so much elevated; and the pulse, which is not so rapid, will aid in the diagnosis. It will, however, often be obscure, and this disease may be complicated with tubercular phthisis. It is generally complicated, to a greater or less extent, with interstitial

pneumonia, but a proximate diagnosis, at least, can almost always be made. As probability is the common guide of life, the probability even in these most obscure cases may be sufficient to justify the expression of opinions and to determine the course of action.

It should be understood that when these dilatation cavities are not large, and are situated deeply in the lung, they may not be detectable by any physical signs; and the rational symptoms are by no means always sufficient to distinguish dilatation of the bronchi from simple, severe, chronic bronchitis.

The *treatment* of bronchiectasis will be similar to that of other cases of severe chronic bronchitis, and its description need not be repeated.

When the sputa and the breath are offensive, various antiseptic inhalations—carbolic acid, creosote, salicylic acid, etc., or the fumes of tar, turpentine, benzoin, etc.—may be used. Tonics are often required and strychnine in various combinations will often be useful.

PULMONARY EMPHYSEMA.

Emphysema of the lungs consists in a superabundance of air in lung tissue, produced either by *distention* of the air vesicles, or by *rupture* of their walls and diffusion of the air into the interlobular spaces or the connective tissue between the lobules. There are thus two varieties of the affection—vesicular or alveolar emphysema, and interlobular emphysema. The latter, the air being in the connective or cellular tissue, is similar to surgical or external emphysema, where the air is diffused in the external areolar or subcutaneous cellular tissue. This latter condition occurs from accident, and is the result of the rupture of the pleura extending to air vesicles or bronchi, and communicating with the tissues outside of the chest, often produced by a spicula of fractured rib. In like manner a rupture of the air vesicles or of bronchi within the unruptured pleura, either by the parts being diseased, or by the extreme pressure of the air in violent inspiration, or in strong efforts at expiration with impediment to the outflow, allows the air to pass into the connective tissue of the lungs. This distends the interlobular spaces, compresses the air vesicles, and diminishes their capacity for receiving air. It presses upon the pulmonary blood-vessels, diminishing circulation through them, and thus interfering with the aeration of the blood, causing, when great, distention of the right side of the heart and congestion of the central venous system: and moreover, by the pressure of this effused air on the nutritive vessels of the lung tissues, the proper nourishment is

interfered with, and atrophie and sometimes other changes are produced within them.

Vesicular emphysema, the other variety, and the one most common, consists of distention of the air vesicles by the same causes which produce their rupture: and not unfrequently in this variety there is rupture of the partition walls between the vesicles, and the conversion of two or more into one. The two conditions may to some extent be combined. Their symptomatic effects are similar. They cannot be distinguished from each other clinically, except when in the interlobular variety, as sometimes happens, the air in the interlobular spaces finds its way along the connective tissue surrounding the bronchi to the root of the lungs, and thence into the mediastinum and the general external cellular tissue, causing noticeable and sometimes extreme distention of the neck, face, trunk, and other external parts of the body. Sometimes, in this latter variety, the air is freely effused under the pleura, causing air-blebs, and it is then called subpleural emphysema.

Etiology.—There has been not a little theorizing upon the etiology of emphysema—upon the immediate causes which produce the anatomical state. Some have contended that the distention or rupture is produced by the dilating force exercised during the act of inspiration; others have attributed it to the force exerted in expiration; while others still have contended that it was due to nutritive impairment in the walls of the air vesicles which become distended or ruptured. It seems strange that any should insist upon these exclusive methods of its production, when it is so evident that either or all may take part in the production of the effect. Moreover, it is evident that another principle may act in producing this distention, viz., that of compensation, which has been referred to in explaining bronchial dilatation. When a given capacity of the chest exists which the lung fills, collapse or diminution of one portion must, to prevent a vacuum, be compensated for by the distention of another. The common atmospheric pressure, without violent inspiration, or expiration, or weakness in the walls of the vesicles, may distend them to fill the space. In the latter case the emphysema will of course be partial and local, the general size of the chest not being increased by it.

The particular or more remote causes which produce emphysema are various. It exists sometimes in a remarkable degree in glass-blowers, from taking a full breath and making strong expiratory efforts in inflating their wares. That strong expiratory efforts tend to produce emphysema, the frequent occurrence of the affection in glass-blowers proves. It is true that these persons before these forcible expiratory efforts distend their lungs by full inspirations, but by far

the greater violence is exercised in the expiratory efforts. At first view it would seem that pressure upon the lungs in every direction would tend to diminish rather than expand the vesicles. But it must be borne in mind that the thorax contains the heart and large vessels as well as the lungs. When its walls are violently compressed the blood is driven out of the cavity of the heart and vessels, as is evident from the turgescence of the vessels outside of the chest; and this leaves room for the greater expansion of the lungs; and the tensity of the air pressure within, in the forcible expiratory efforts, distends the vesicles. In confirmation of this view it is found that the emphysema in these and other cases from a similar cause is greatest in the region of the heart and large vessels. It may be produced by other violent straining efforts. It is sometimes the result of hooping-cough and often of asthma—the air in this latter affection passing into the lungs by violent inspiratory efforts with more freedom than it passes out, in the absence of as forcible expiratory efforts, thus gradually produces distention. Perhaps the most frequent cause—as this is of frequent occurrence—is chronic bronchitis. The long-continued cough and labored breathing produce the result. In acute bronchitis there is more or less temporary emphysema, but in chronic cases either of bronchitis or asthma it becomes permanent. More or less of emphysema is present in most of the cases of chronic bronchitis. The emphysema in this disease is accounted for on the same principle as in the case of the glass-blowers. The frequent and violent expiratory acts in coughing produce the same effects as in blowing, and the result may be aided by changes which may take place in the lung tissues, in the diseased action extending to them from the bronchi. Besides, in coughing, forcible inspirations are taken before the explosions, as well as forcible expirations in the act of the cough, so that the analogy between blowing and coughing is maintained throughout.

Symptoms.—A moderate degree of emphysema may exist without producing any noticeable symptoms. When occurring in scattered lobules throughout the lungs, it may scarcely be detectable. When occurring to any considerable extent, and in a continuous portion of the lungs, it is generally the most in the upper lobes, and is said to be usually more marked on the left side than the right, a circumstance, however, which I have not specially noticed. The disease produces distention of the parts affected, and the chest presents a peculiar fullness and contour called the “barrel-shaped” chest. The lung substance is attenuated by its distention and loses a large part of its elasticity. The persistent air is much increased, but the tidal air is diminished, and the range of motion in inspiration and expiration is

less than normal. This, together with obstructed circulation of blood through the lungs, diminishes the oxygenation and produces a sense of dyspnœa. If the case is not a severe one, the patient may not suffer when at rest; but on exertion, as in walking rapidly or running, and especially in going quickly up stairs, the dyspnœa is often excessive. In severe cases it is constantly felt, the patient is unable to lie down in bed, the lips and surface are cyanotic, the right side of the heart is distended, the venous system is congested, the liver and other abdominal organs are distended with blood, the lower extremities become œdematous, and at length general anasarca supervenes, and in time the patient succumbs. The disease seldom or never reaches this extreme unaccompanied by some degree of bronchitis, cough, and expectoration. The bronchitis presents the ordinary characteristics. The cough is often spasmodic, and consists of a succession of short expiratory efforts, something like those of whooping-cough. During the paroxysms of coughing the face is congested, and often extremely so, while the right heart is distended and enfeebled. The expectoration varies in quantity and composition, depending upon the character of the bronchitis, but it is with difficulty expelled, owing to the limited range of the expiratory movements; accumulations in the bronchi are therefore likely to occur, and increase the dyspnœa.

There are no characteristic general symptoms aside from those mentioned, and the diagnosis depends upon these and the physical signs.

Diagnosis.—Emphysema is to be distinguished from bronchitis, bronchial asthma, chronic pneumonia, pneumothorax, from cardiac disease with dyspnœa, and from aneurism of the aorta, and glandular enlargements of the chest. These conditions and their peculiarities should be borne in mind, and proper comparisons made. The physical signs should be carefully observed.

On *inspection* the upper and middle parts of the thorax are found distended, while the lower part is more contracted, giving the chest the barrel shape before mentioned. The ribs, instead of being in the usual oblique position, are nearly horizontal. The motions in respiration are limited in range. The inspiratory movement is not only limited in extent, but short in time; while, on the contrary, the expiratory movement is slow and prolonged in duration, and the parts above the clavicle and sternum often sink in on inspiration.

On *percussion*, upon the upper part of the chest the resonance is markedly greater. In ordinary cases it is *exaggerated vesicular*. The intensity is greater, the pitch is *lower*, and the quality is soft and vesicular. In extreme cases the resonance is *vesiculo-tympanitic*.

The intensity is still greater, the pitch, however, is *higher*, and the vesicular and tympanic qualities are combined. This quality is more marked over the upper part of the left than the right lung, and might by comparison give the impression of dullness, as from solidification on the right side. But it should be remembered that the percussion note on the right side is normally duller than on the left, and with the same amount of emphysema on each side, this difference to some extent would exist. If the left side is more subject to emphysema than the right, this would make this difference more frequent. By comparing the upper part of the right side with the part in the same lung below, the error in regard to its consolidation would be likely to be observed, and, when the evidence of auscultation is added, it would be more sure to be corrected.

Percussion will also show that the lung extends lower down in the chest than it does normally, depressing the diaphragm and displacing more or less the heart and liver. The heart, however, instead of being pressed down, may be covered over by the expanded lung so that its sounds are obscured, particularly those of the left side, and the percussion note over the usual triangular space will be more pulmonary.

On *auscultation* the respiratory murmur over the part affected will be feebler than normal, the inspiratory sound will be shortened, while the expiratory, in many cases, will be prolonged. This is not high pitched and tubular, as in consolidation of the lung, but has the character of the normal expiratory sound. Dry, sibilant, and sonorous râles are often heard from the pressure of the emphysematous lung on some of the bronchial tubes, even when neither bronchitis nor asthma is marked. The vocal resonance and fremitus are normal. As the lung in its expansion covers the heart, the area of cardiac dullness on percussion is lessened or abolished. The impulse of the heart will be less seen and felt at the apex, but more, perhaps, at the epigastrium. The proper study of these signs, and the symptoms that have been related, will lead to a differential diagnosis. From bronchitis it will be distinguished chiefly by the change in the shape and size of the chest, by the increased sonorousness on percussion, by the greater dyspnœa on exertion, and by dropsical conditions from the greater obstruction to the circulation. From asthma by the paroxysmal character of the latter, while in emphysema the dyspnœa is constant. From pneumothorax it is distinguished by the history—air in the cavity of the chest, and compression of the lung coming on suddenly, and in connection with some other disease or injury producing it. From catarrhal or chronic fibroid pneumonia it is distinguished by the history of the case, and the special physical signs; and

from organic heart disease by the physical examination of that organ.

Prognosis.—This is unfavorable as to cure, though the patient, when the disease is uncomplicated, may have a long lease of life.

Treatment.—Very little or nothing can be done directly with medicines in relieving the anatomical condition of emphysema. The chief indications of treatment arise from the often accompanying bronchitis and asthma. These are to be treated on the same principles as if the emphysema did not exist. Relieving the bronchitis or the asthma will not only cause the emphysema to be better borne, but will prevent its increase, and will sometimes result in a diminution of the emphysematous condition. Prof. Flint says he has known the characteristic deformity to be notably diminished when the iodide of potassium effected a marked improvement as regards the chronic bronchitis.

The palliative treatment of emphysema by means of compressed air, is founded on correct physieal principles. The range of respiratory movements and the bulk of air taken in and expelled at each respiratory act being diminished, and insufficient oxygen being thus obtained, the condensed air will afford a greater amount of oxygen, and the symptoms of dyspnœa will be relieved. In a chamber where the pressure is increased by one and a quarter to one and a half atmospheres, the patient with extreme emphysema is much relieved of his sense of dyspnœa, and is made more comfortable. This requires a special mechanical arrangement for forcing the air into the room, which is available only in exceptional cases. To take the place of this "pneumatic chamber," an instrument has been contrived for forcing condensed air into the lungs in inspiration, and, with the same instrument, pumping the air from the lungs in expiration; or, what is the same thing, allowing expiration to take place into rarefied air. By breathing through a tube provided with a mouth-piece and attached to an accordeon, inspiring when the bellows are compressed, and expiring when they are distended (the ordinary valve, of course, being kept closed), the air, more or less compressed and condensed, is forced into the lungs, and, by the reverse movement, is forced out, thus increasing the amount of tidal air, which is the efficient element in respiration. It is claimed that by this method not only the dyspnœa from the emphysema is relieved, but the accompanying bronchitis is greatly benefited and often cured, and the emphysema, in a considerable proportion of cases, is cured or materially relieved also. An apparatus, modified from a German invention and manufactured in Chicago under the direction of Dr. F. H. Davis, has been accessible

to me for some two years, but has not been tried sufficiently in actual disease to enable me to speak from experience of its efficacy. In the use of the apparatus decided efforts at full inspirations and expirations are likely to be made, and this, with a more thorough clearing of the lungs of residual air by the aid of the pump, improves the action of the heart, and, for the time, the circulation; but its great curative effects in bronchitis are not yet proven by experience, at least not in this country. The matter, however, is worthy of further investigation and trial.

For the asthmatic attacks so often accompanying emphysema, the usual remedies will be required, among which may be mentioned hypodermic injections of morphine and atropine ($\frac{1}{6}$ to $\frac{1}{120}$), and, according to Bartholow, next to this fifteen or twenty grains of the iodide and forty of the bromide of potassium every two, three, or four hours, and the other asthmatic remedies described under the head of that disease.

There is a general agreement that the iodide of potassium is exceedingly efficient in the bronchitis accompanying emphysema, and should be continued in decided doses often for a long time.

The iodide of ammonium and arsenic in combination are said to have been followed by excellent results in emphysema with bronchitis, the remedy continued for some time. It is thought that "arsenic increases the depth and volume of respiration and promotes the nutrition of the lungs" (Bartholow), and if this be so it is certainly indicated in these cases, provided it does no mischief in other respects.

The dropsy accompanying severe cases of emphysema must be carefully managed. The remedies applicable to this form of dropsy will not differ from those required in other cases produced by obstructed circulation. Diaphoretics, jaborandi or pilocarpin, if the condition of the heart will allow of its use; diuretics, bitartrate of potash, vinegar of squill with bicarbonate of potash (Niemeyer), infusion of digitalis, etc., and the hydragogue cathartics, as may be borne, are the proper remedies.

SENILE PULMONARY ATROPHY.

There is a form of *senile disease*, generally called emphysema, which consists of atrophy and destruction of the walls of the air vesicles, so that at some points considerable cavities are formed by the coalescence of several alveoli. The lungs, however, generally become diminished (and sometimes greatly so), rather than increased in size, and the chest walls are contracted rather than expanded. The term

pulmonary atrophy, rather than emphysema, should be applied. The patient has usually sufficient breathing capacity for a state of quiet and rest, but has dyspnœa on exertion. If the atrophy be more extreme and the cavities large and numerous, the dyspnœa may be constant with rapid respiration, and a cyanotic condition may occur. It is not an unfrequent abnormal condition in its milder forms, and the common shortness of breath in old people is often produced by it. This shortness of breath is also due in part, and in many cases perhaps wholly, to ossification of the cartilages and stiffness of the walls of the chest, and to feebleness of the respiratory muscles.

Those affected in this way, as well as persons with common emphysema, cannot pronounce long sentences without stopping to take breath.

In these atrophic conditions of the lungs the signs on auscultation and percussion will not differ from those of emphysema; but the chest is contracted instead of being expanded, and the signs of other diseases that might produce such contraction are absent. From these facts the diagnosis can be made out.

This condition of the lungs is not perhaps directly remediable, and when no other morbid state is present, remedies, aside from care in regard to exercise, exposure, etc., are not called for.

Those who have confidence in the power of arsenic to promote full respiration and the nutrition of the lung substance will be likely to prescribe it in these cases.

PULMONARY GANGRENE.

By gangrene of the lungs is meant death of a portion of the lung tissue. It arises under a variety of circumstances, and is in two forms; in one the gangrene is *diffused*, and is usually more extensive; in the other it is *circumscribed*, and commonly more limited. The distinction is not very definite, as these forms may shade off into each other, and a circumscribed gangrenous spot may afterward become diffused. Still, the distinction is properly made, as in well-marked cases the symptoms, physical signs, and prognosis are different. The term circumscribed is applied when the gangrene is limited to one or a few portions of the lungs from the size of a cranberry to that of an orange. It is said to be diffused when much more of the tissue is involved, and especially when an entire lobe, or even, as may happen, when an entire lung is involved.

Causation.—The most common cause of a diffused gangrene is a severe pneumonia, or a pneumonia occurring in a debilitated or

cacheetic subject. In these cases, when at all extensive, it is almost necessarily fatal.

Circumscribed pulmonary gangrene is more frequently the effect of pulmonary embolism. A clot of blood closing an artery cuts off circulation, and death of the part follows commensurate in size with that of the artery.

Gangrene, more or less circumscribed or diffused, may result from chronic bronchitis, with dilatation of the bronchial tubes and other obstructive conditions which this disease may produce. It sometimes follows a pulmonary hemorrhage, and is produced by the lesions which are the causes or consequences of the bleeding; and it occasionally occurs in a more limited or extended form, preceded by no marked symptoms indicative of any particular disease, other than a debilitated or lowered condition of the general system.

Very generally, from whatever special cause gangrene of the lung is produced, there is a lowered or cacheetic state of the whole system, as from starvation, bad hygienic conditions, drunkenness, or from some constitutional disease or dyscrasia predisposing to it. It occurs more frequently in men than women, and is said to be more common from puberty to middle life. It is sometimes secondary to typhus, small-pox, and other eruptive fevers, and the septic or putrefactive affections in other parts. It may be caused by the presence of foreign bodies, or by wounds of the lungs.

Symptoms.—The general symptoms of pulmonary gangrene are not sufficiently characteristic to distinguish it from other affections. The *diagnosis* is made by the very offensive odor of the breath and expectoration, and by the appearance and microscopic characters of the materials thrown up. The odor can only be mistaken for that which occurs in some cases of chronic bronchitis with dilatation of the tubes, in breaking-down cancer of the lungs, or in some rare cases of pneumothorax. It, however, differs from these, is generally more intense, and is characteristic, though not easily described. The expectorated material from a gangrenous lung is very dark—almost or quite black—varies in consistence, and, examined under the microscope, will be found to contain fragments of pulmonary tissue—especially portions of elastic fibrous structure, which resists longer than other parts the decomposing processes.

Morbid Anatomy.—The pathological anatomy will be understood from the description which has been given. The partially organized membrane surrounding the gangrenous mass pours out a sanious, purulent fluid, which joins with the decomposing slough in furnishing the offensive expectoration, which occurs when an opening is

made into a bronchus. The pleura may be involved when gangrene is near the surface of the lung, and adhesive inflammation may confine the matter to a limited space, or it may travel, dissecting its way to more distant parts; but usually an opening is formed into a bronchus, when the case is much protracted.

In some cases the gangrenous matter becomes encysted, or is inclosed in an imperfectly organized false membrane, which shuts off the odor, and prevents the characteristic expectoration. The diagnosis in such a case can only be made post mortem.

A peculiar case was witnessed by me many years ago. A boy about four years old had suffered for a few weeks with some symptoms, the full character of which I did not ascertain. When seen, he was exceedingly depressed and anæmic, though he had been previously in fair health. His breathing was short and rapid, the pulse rapid and feeble, and every few hours he vomited up a dark material having an exceedingly offensive odor which filled the apartment. There was no cough or expectoration, and the terrific odor was only perceived when this matter was ejected from the stomach. On examination of the chest there was flatness on percussion, and silence on auscultation over the lower part of the right lung as high as the nipple. The line of dullness and silence was not changed by change in the position of the body. In a very few days an opportunity for an autopsy was afforded, which revealed the fact that gangrene of that portion of the lung had occurred, and it was partly broken down; that an inflammatory exudate was poured out above the gangrenous portion, plugging up the bronchial tubes, and separating, as in a gangrenous extremity, the living from the dead part. The vomited material came from this gangrenous lung, and found its way into the stomach by an opening through the pleura, and into the œsophagus just before its entrance into the stomach. This was produced by an adhesive and ulcerative process like the traveling of an abscess. The original disease was probably lobar pneumonia, terminating in gangrene.

Diagnosis.—The physical signs of pulmonary gangrene are not characteristic; but when the gangrenous mass is of considerable size, there will be dullness on percussion and other evidences of consolidation; and after breaking down has occurred there may be evidences of a cavity; and while expectoration is going on, there are often bronchial râles. Hæmoptysis may occur from the opening of vessels, but it is not usual. Before the gangrenous matter is discharged, rendering the diagnosis certain, in secondary cases there may be a lowering in the type of the disease, a sudden depression of the powers of life, with sometimes a high temperature, but in other cases a collapsed condition which may create suspicion of the occurrence of gangrene.

Prognosis.—The prognosis of pulmonary gangrene is grave, but it depends upon its extent and the circumstances of the case. Patients sometimes recover after quite large gangrenous cavities have formed, and sometimes with comparatively slight symptoms, the dead matter being discharged and the cavity contracting and cicatrizing. A case is called to mind where a recent emigrant from Ireland expectorated for some time a quantity of gangrenous matter, and presented other evidences of a cavity of considerable size; but the young woman did not at any time take to her bed, and in time entirely recovered.

Treatment.—The *treatment* will be symptomatic and supporting. If the cough is excessive it should be allayed. The system should be kept up by a nutritious diet and by tonics. Moderate doses of quinine, and often small doses of opium in addition, will tend to do good. Alcohol in the form of egg-nog may be useful in cases of much depression from shock; and good results are said to have occurred from the use of oil of turpentine in five-drop doses every two hours. Recently eucalyptol, in doses of five or six drops, best given in pearls, has been strongly recommended in these cases. It may be given in an emulsion, which is the best method of administering the oil of turpentine. Benzoic acid, thymol, creosote, and carbolic acid may produce antiseptic effects, and by passing off from the lungs tend to correct the offensive odor. Acetate of lead has been recommended by Traube, but upon what principle it produces beneficial effects is not easily understood. The inhalation of the vapor of turpentine is advised. The vapor of carbolic acid is still more antiseptic. Salicylic acid and the vapor of iodine may also be useful. Either may be used by means of the atomizer, or the turpentine by pouring a few teaspoonfuls on warm water and breathing the vapor; and the carbolic acid and iodine may be used in this manner. The benzoate of soda may be used freely with an atomizer.

CARCINOMA OF THE LUNGS.

Cancer of the lungs as a primary affection is extremely rare, but it occurs oftener as secondary to the disease elsewhere, and is not very unfrequently developed in this structure after the removal of a cancerous breast. It may occur in the form of nodules or larger masses, disseminated often in both lungs and in neighboring parts; or in the form of diffused infiltration. It may take either the encephaloid, the colloid (rarely), or the scirrhus form. In the latter the lung is often contracted. In the two former it is likely to be enlarged. The encephaloid is the most common.

The local symptoms are not so definite as to be distinctive, unless tumors of the same kind appear in the walls of the chest. When the tumor is sufficiently large to replace a considerable portion of lung, there will be dullness or flatness on percussion, and an absence of breath sounds. When of smaller size there will be less dulness, and often broncho-vesicular respiration will be heard and an increase of vocal resonance. When secondary bronchitis is produced, as is often the case, there may be presented its signs—the bronchial râles.

The local phenomena may resemble the crude stage of tuberculosis; but the history of the case—the cancer not being liable to occur in the upper more than in other parts of the lung—and the general symptoms will lead to the distinction.

When one lung is affected by cancerous infiltration causing enlargement of one side of the chest, the case may resemble one of pleuritic effusion of serum or pus; and, as often happens, if serous effusion occurs in connection with the cancer, a diagnosis by means of the physical signs will be difficult, and perhaps impossible. The history of the case, however, will aid, and as the disease advances its nature will be revealed. An exploratory aspiration will often render the diagnosis more clear. Cirrhosis of the lung may resemble cancerous infiltration. The history of the case will here again aid, and the steady and more rapid progress of the cancer may be conclusive.

The prognosis is of course fatal, and the treatment can only be symptomatic and palliative. Anodynes will generally be called for.

Other morbid growths or tumors in the lungs—such as fibroma, myxoma, lipoma, osteoma, or enchondroma, and dermoid cysts, are exceedingly rare, are incapable of distinctive diagnosis, and are also incapable of any other than simply palliative treatment according to the symptoms, and are chiefly interesting to the pathologist. It is well to know that such growths are possible in reference to diagnosis and prognosis in obscure cases. Their presence is often borne without much irritation, and their more full description need not here be entered upon.

Mediastinal tumors, generally malignant, sometimes occur. By their growth they may oppress the lungs and heart and their appendages, displacing them more or less, and sometimes producing bulging of the sternum. Difficulty of breathing—sometimes from involvement of the nerves as well as from pressure upon the air passages—is among the most prominent symptoms; though obstruction and irregularities of the circulation, and not unfrequently pain, are present.

The lateral extension of the tumor may be determined by percus-

sion ; and a proper knowledge of the morbid conditions resembling these appearances must be the chief guide to a differential diagnosis. As in other internal tumors incapable of removal, the only legitimate object of treatment is to aid endurance by palliative measures.

Hydatids of the Lungs—Echinococci.—*Hydatids* sometimes appear in the lungs as well as in the liver. They are more likely to occur in the liver when the germs are received by the stomach in food ; but are more apt to be in the lungs when these germs are received by the inhaled air. In countries where dogs abound, where the streets are dry, and winds often raise clouds of dust, hydatids of the lungs are said to be very frequent. In our country they are rare. They are slow in their development, and are not distinguishable either by symptoms or signs until they attain considerable size. They may attain such dimensions as to displace the heart or lungs, or depress the diaphragm, interfering with the functions of circulation and respiration. They present the physical signs of other tumors of the lungs, and a very large one may simulate pleuritic effusion. A hydatid situated in the upper part of a lung may present signs resembling tuberculosis.

There will be an absence of general phthisical symptoms in the cases where the physical signs resemble those of consumption, and an absence of the history of a pleurisy where the physical signs resemble a pleuritic effusion. The system of exclusion may lead to a probable diagnosis ; but nothing will be conclusive of the presence of hydatids but the appearance of the hooklets or other parts of the parasites in the expectoration in the cases resembling consumption, or of the same substances in the fluid obtained by an exploratory operation in those resembling pleurisy.

The *course* and *prognosis* are uncertain. The termination either in death or recovery, but with more or less pulmonary impairment, is usually within four years. An opening may occur into a bronchus at a much earlier period, and the contents of the cyst be expectorated. Of forty cases reported by Davaine in his treatise on Entozoa, twenty-five died and fifteen recovered. A majority of spontaneous recoveries take place from the contents of the cysts finding their way into the bronchi and being expectorated.

The deaths which have occurred in a large proportion of cases are due to these different causes—to hectic and wasting, to the development of tubercles or the occurrence of hemorrhage, to gangrene or pleuritis, or to exhaustion from profuse suppuration and expectoration.

The *treatment* of hydatids of the lungs, as well as of the liver, consists in aspirating the fluid when it can be done, or sending through

the part an electric current. When this cannot be done, simple palliation of the symptoms is all that is called for.

In this disease, when left without radical treatment, the prognosis is uncertain, but according to the statistics referred to it is unfavorable. Some recover, as stated, by the efforts of nature, getting rid of the parasites; others linger a long time, suffering from the foreign intruders, while others succumb sooner to the diseased conditions excited by their presence.

Other parasites in the lungs are possible, but they are so rare as to justify the omission of anything beyond this simple allusion to them.

PLEURISY.—PLEURITIS.

Pleurisy is an inflammation of the serous membrane lining the cavity of the thorax and enveloping the lungs, and constituting their external covering.

Ordinary idiopathic pleurisy is a simple inflammation of a typical serous membrane, and has the characteristics of inflammation of such membranes, as described in the general account of inflammation. Its pathology is simple and typical, and need not in this place detain us with its minute details.

Pleuritis, like inflammations of other parts, is divided into *acute* and *chronic*, into primary and secondary; and other distinctions are made which indicate differences in its etiology, and various grades in its intensity and character.

Symptoms.—An attack of *simple, acute, primary* pleuritis is generally abrupt, and is not preceded by any significant premonitory conditions. As in most acute inflammations, it is usually ushered in by more or less chilly sensations; seldom by as profound and protracted a chill as usually accompanies the commencement of an attack of lobar pneumonia, but by rather more than occurs in an attack of common bronchitis. Increase of temperature is among the first symptoms, and is usually present in the deeper parts of the body while the cold sensations are felt by the patient, but it seldom goes above 103° in the axilla. The pulse is soon increased in frequency, but not often above 100 per minute, and generally it is augmented in fullness more than in pneumonia, and especially more than in bronchitis.

Pain is usually an early and prominent symptom. It is sharp, cutting, and catching, or stitchy, and is felt most in the act of inspiration. It is greater as the inspiration continues and is more deep, and this causes the patient to shorten it and make it superficial. The pain is

commonly most intense at the lower and lateral or anterior part of the chest, but extends more or less over the side affected. When a serous effusion takes place, which often occurs before many hours, the pain markedly abates; and when a fibrous exudate covers the inflamed surface, the pain is also more or less relieved. It does not, however, often entirely disappear, especially on a full inspiration, unless a free serous effusion separates the whole inflamed costal and pulmonary pleural surfaces.

Cough is usually present in pleurisy, but it is dry and short; and as it increases very much the catching pain, it is as much as possible suppressed, and is not a prominent symptom. Unless a bronchitis or pneumonia complicates the case, there is nearly, or quite, an absence of expectoration, and what little may occur will be simply mucus. In bronchitis (and comparisons may be made as we proceed), as we have seen, expectoration is almost never absent; and in pneumonia, not long after the invasion, unless it be strictly interstitial, which in acute cases is exceedingly rare, cough and expectoration come on, generally with characteristic *rusty* sputa. In pleurisy the face is pretty uniformly flushed, and usually of a bright red color; while in pneumonia there is a red and purple-tinted flush of the cheeks more than of other parts of the face, while some parts have a sallowish paleness.

In bronchitis, unless it may be very severe or of the capillary variety, the face is not greatly flushed or especially purplish.

The respirations are increased in frequency in the early stages of pleurisy, chiefly to compensate for their shallow and incomplete character, though the fever contributes to their increase. When in the later stages free effusion takes place, the respirations are increased in frequency because of the compression of the lung, and the diminution of its capacity for receiving air.

In pneumonia the frequency of the breathing from the beginning is chiefly in consequence of the incapacity of the lung to receive the full supply of air; while in bronchitis the frequency of breathing is not materially increased, as the capacity of the lung for air is not diminished; the only difficulty is in getting it through the tubes, and this not being great in ordinary cases, dyspnoea is not a marked symptom. In capillary bronchitis, however, the deficiency of air received into the lungs is so great that an intense feeling of dyspnoea is produced, and violent and rapid efforts are made to get a supply.

These general phenomena it is important to observe in making an early differential diagnosis; and it has been thought best to make this comparison in describing the early symptoms of the disease.

Stages.—There are several stages or degrees of pleuritic inflammation, which it will be well to notice.

The first stage is that which occurs before effusion takes place, and is called the *dry stage*. In it the inflamed membrane is hyperæmic, the vessels stand out upon its surface enlarged and prominent, and this, with the early infiltration, renders its tissue rough and thickened. A pleurisy may not go beyond this dry stage, the case being mild with very little fever, and the whole terminating in thirty-six or forty-eight hours.

In the next stage, when the inflammation is not of a degree or character to produce much plastic or fibrinous and corpuscular exudation, or to produce pus, a serous effusion is poured out. This is called the *effusive stage*. More or less serous effusion usually occurs, even in the milder forms of the disease. Indeed, an effusion which will ultimately seriously interfere with respiration may be attended with but slight symptoms in the early stage of the inflammation which has produced it.

In a severer grade of the inflammatory action, and one of a different type, a plastic exudate is produced forming a false membrane on the inflamed surfaces. This is called the *exudation stage*, or *plastic degree* of the inflammation.

In a still severer but lower grade of the inflammation pus is produced, and this is called the *suppurative stage* or degree of the disease.

If the inflammation subsides and the pleura approximates to a healthy state, the false membrane which is exuded begins to organize, loops of vessels shooting into it from the pleural surfaces. This organized membrane agglutinates these surfaces together and forms the adhesions so often met with in subjects who have suffered from pleurisy. This is called the *adhesive stage*.

Again, when serous effusions take place and the inflammation subsides, the effusion is taken into the blood-vessels and lymphatics and carried away. This is called the *absorptive stage*.

And still again, when a false membrane becomes organized around a lung, and, following the law of such adventitious tissue, contracts, causing compression of the lung and depression of the thoracic walls, this may be called the *retractive stage*.

When from the suppurative process a free quantity of pus is produced in the chest, and, gravitating to its dependent part, remains there, this is called *empyema*.

When adhesions form in consequence of the partially organized false membrane that is deposited and by the continuance of the inflammation, suppuration takes place at some point away from the margin

of the membrane ; this margin remaining adherent and thus confining the pus in a cavity, a circumscribed collection of pus is produced. This constitutes a *pleural abscess*, and might be called the stage of *abscess*.

The symptoms and physical signs will differ in these different conditions.

In the dry stage the symptom of pain is more marked, the fever is generally at its height, and the breathing is restrained and catching.

In the stage of effusion the pain abates or disappears, the fever is less after a little time, and if the quantity of fluid becomes large, difficulty of breathing comes on from the pressure upon the lung.

When the plastic stage is present the pain is commonly lessened and the fever somewhat abates ; and when suppuration occurs the pulse generally becomes softer, but often more rapid, the fever may become more remitting and sometimes hectic in character, and emaciation, anæmia, and depression generally advance.

When an abscess forms it sometimes points toward the surface of the chest, and sometimes into the lung, and may be discharged either externally, or into the bronchi and become expectorated. This requires time, and is usually accompanied by more or less hectic symptoms, and when the rupture is internal, cough will be developed.

All cases by no means go through with all these stages. In a large number of instances, perhaps a majority, the case goes no further than the stage of moderate effusion, and absorption then takes place on the subsidence of the inflammation. In other cases a moderate amount of plastic exudate is poured out, mingled with serum which does not organize, but soon undergoes solution and absorption. In still other cases the plastic material is more abundant, and, mingled with less serum, it becomes organized to a greater or less extent, as already mentioned, causing adhesions on recovery. In other cases still, the suppurative processes occur ; and sometimes all processes are arrested by the death of the patient. This event occurs less frequently than in pneumonia, far less than in capillary bronchitis, but oftener, in proportion to the number attacked, than in ordinary bronchitis. Pleurisy is a much less frequent disease than croupous pneumonia, and especially is it less frequent than bronchitis, though more frequent in adults, and perhaps less frequent in children than capillary bronchitis. On the whole it is not a very formidable disease, though one of much interest, often producing severe suffering, and not unfrequently becoming much protracted ; but the general prognosis is rather favorable.

Physical Signs.—The *diagnosis* of the disease and its different

conditions is to be made by observing the symptoms which have been detailed and comparing them with the diseases with which it is most likely to be confounded; but the diagnosis is more positively to be made by taking in connection with the rational symptoms the *physical signs*.

In the first or dry stage, on *inspection* the statical state of the chest is of course not changed; but the motions will be somewhat irregular and restrained. The patient will frequently incline to the affected side in bed, and may press upon it with his arm to prevent motion, instinctively putting himself in a position to allow free motion of the unaffected side, and to restrain the motion of the diseased one. He will in this stage sometimes prefer to lie on the well side, as gravitation will diminish the quantity of blood in the inflamed part; but he will at other times prefer to lie on the diseased side, thereby diminishing its motion, and rendering more free the motion of the healthy one. There is therefore no uniformity as to the decubitus. Nothing peculiar will be discovered by palpation other than is observed by the eye.

Percussion also in this stage will be negative in the sounds elicited; but it will usually give pain to the patient.

On *auscultation* the respiratory sound will be short, and often interrupted by the restrained and irregular motion of the chest; but the characteristic sign of this stage is a superficial rubbing or *friction* sound, arising from the roughness of the pleural surfaces gliding over each other in the act of breathing. It has different characters and different degrees of intensity, depending upon the amount and quality of the roughness and the extent of the respiratory movements, a full breath developing or increasing it. It often resembles the sound produced by rubbing bits of some sorts of fabrics together near the ear, and may be confounded with the sound produced by friction of the clothing when interposed between the surface of the chest and the stethoscope or the ear.

This sound is, however, far from being always heard when the chest is examined in this stage. The roughness or the motion may not be sufficient to produce it, and the effusion taking place early may remove the conditions producing it before the examination is made. Its absence does not disprove the existence of the early stage of pleurisy. Its presence, however, is quite conclusive of roughness of the membrane. There is no such sound produced when the pleural surfaces are in their normal state.

In the effusive stage the friction sound is not heard except when the fluid gravitates, leaving the roughened surfaces above in contact. When there is much effusion, inspection will show increased fullness

of the side; and *mensuration* will confirm it. The intercostal spaces will be broader and less depressed or more prominent; on *palpation* the vocal fremitus will be diminished or abolished, and on *percussion* there will be dullness or flatness according to the amount of the fluid present. On *auscultation* the respiratory murmur will be feeble or absent, according to the amount of fluid—and if there be much fluid, there will be entire silence over its situation. Often an undulatory or fluctuating sensation can be produced by tapping upon one part while the hand is applied to another.

On changing the position of the patient the line of dullness or flatness and of silence will change, preserving a horizontal direction when the fluid is free in the cavity. In the upright position this line will be at right angles with the axis of the body. When the patient lies upon his back, the dullness will recede from the anterior wall of the chest, etc. Immediately above the line, when the lung substance is not changed, the percussion note will be full and generally distinctly vesiculo-tympanic, and the contrast above and below will be very marked. There can be no mistaking the significance of these indications.

In acute cases the amount of fluid is seldom large, and the distention and fluctuation may not be perceptible. Diminished resonance will, however, be present, and a feeling of solidity or resistance will be felt by the examiner on percussion.

When plastic exudates are present, inspection will only show somewhat diminished motion; palpation may show some variation of the vocal fremitus; and percussion will give a degree of dullness, according to the amount of the exudates. Auscultation will now present diminution or absence of the respiratory murmur (seldom the latter), and now will often be heard rough, rumbling, or squeaking friction sounds, as the motion of breathing rubs the somewhat agglutinated and roughened surfaces together. When adhesions form and become firm these sounds may disappear; but sometimes even then, on full inspiration, a squeaking sound, like that of a new saddle, may be heard.

When contraction takes place, inspection and mensuration will show diminution of the affected side.

The physical signs of *empyema* are precisely those of serous effusion when adhesions have not taken place, when the fluid is free in the chest, and when the lung substance is not diseased. In true empyema, or free pus in the chest, sometimes called pyothorax, the lungs are more likely to be affected, and thickening by plastic exudates is more likely to be present.

When the matter is confined by exudates and adhesions, and

especially when a circumscribed abscess is formed, the boundaries of the dulness and silence will not change on changing the position of the body, and when the abscess points externally, the prominence, and finally the fluctuation and discoloration of the skin, will be diagnostic.

When an abscess points internally, and the pus is discharged through the bronchi, there will be the usual signs of cavity—amphoric resonance on percussion; hollow, blowing respiration, or gurgling, moist râles as the matter passes through the bronchi; and bronchophonous or pectoriloquous voice sounds may be heard if the opening is free and direct, and not by small sinuous fistulas.

The physical signs of bronchitis have been sufficiently described, and those of pneumonia will be given when that disease is discussed, so that comparisons can be made.

Etiology.—Pleurisy, in the simple primary form of the disease now under notice, is produced by the common causes of inflammation, by exposure to cold, etc., though certain epizootic forms of pleuropneumonia, dependent upon a zymotic cause, prevail epidemically, and the disease in cattle is regarded as contagious.

A zymotic influence may produce a somewhat similar disease in the human subject, and rarely there are periods when pleurisy particularly prevails. In connection with erysipelas I have seen cases occur epidemically. They then assume a great degree of severity, and are attended with a larger percentage of mortality than has been intimated to be the case in simple primary pleurisy.

Prognosis.—The course and continuance of pleuritis are very various, as the description of the pathological conditions indicates.

A common acute case may terminate in a week or two, or even less; it may often be aborted and terminate in a speedy resolution; or it may become chronic, lasting for weeks or months, and in its consequences for years or a lifetime. It has no fixed period of self-limitation.

Occasionally pleurisy occurs in a *latent* form, not presenting the ordinary symptoms of the acute disease. The patient may feel a slight indisposition, and, for a short time, a little stitchy pain in the side. This may soon pass away and be almost forgotten, the patient going about his usual avocations. At length he begins to experience shortness of breath on exertion, and, in time, severe dyspnœa. On examination a free effusion of fluid may be found in the chest, and only by a physical exploration is the nature of the case revealed. The future progress of such a case will usually be that of a milder form of subacute or chronic pleurisy, but sometimes severe symptoms follow.

TREATMENT OF ACUTE PLEURITIS.

The tendency, in a large proportion of cases of simple, idiopathic, acute, unilateral pleurisy, is to terminate in recovery. It seems to me hardly proper to say, however, that it "has no tendency to a fatal termination."* The very next sentence, in the work quoted, seems to contradict this. It is: "If it prove fatal *per se*, the immediate cause of death is a rapid and large pleuritic effusion, and the mode of dying is by apnœa." But it may cause death by other means. When the inflammation is extensive and severe, death may be caused by the shock, as in inflammation of another serous membrane—the peritoneum—and the mode of death may be by asthenia. Besides, when it results in suppuration, not only may a long course of suffering be entailed, but exhaustion and death may follow, and sometimes before the disease can properly be called chronic. It is very far from being a harmless affection, and its treatment is a matter of importance. Though, when it remains uncomplicated, it rarely proves fatal in its acute form, yet the inflammation *very frequently* extends to the lung substance. Indeed, the interstitial or connective tissue of the lungs, so intimately connected in its structure with the pleura pulmonalis, is almost necessarily involved to a greater or less extent when that membrane is inflamed, and not unfrequently, indeed commonly, the alveoli are also implicated to a greater or less degree. This must be taken into the account, in determining the necessity and the course of treatment. The possibility, which is not slight, of its becoming chronic must also be considered. Resolution, and a speedy termination of the disease, should, if possible, be secured. Have we the means of arresting this inflammation, favoring its resolution, and bringing it more speedily to a favorable termination? If not, our whole efforts should be directed to palliating the sufferings of the patient.

Among the remedies to which most writers first direct attention is blood-letting. Nearly all agree that its immediate effect is to relieve pain and palliate the symptoms. Prof. Flint says: "Blood-letting at the outset is admissible in a healthy subject, inasmuch as the tendency of the disease is to recovery. The advantages of blood-letting are its promptness and efficiency in relieving pain and dyspnœa." He regards it as simply a palliative measure, but says that, with a little delay, relief may be obtained by other means. If its only beneficial effect is immediate palliation of the suffering, and if this can be effected by other means, and the reason for its

* Flint's Clinical Medicine, p. 86.

admissibility is that the disease tends to recovery, it would seem that the remedy might with great propriety be omitted altogether. It is not a remedy to be resorted to unnecessarily. In a majority of cases, in my judgment, it should thus be omitted, as we have other means generally more efficient in relieving pain and influencing favorably the course of the disease. When, however, the patient is of full habit, and can afford without injury a loss of blood, venesection may be practiced, and not only pain and dyspnoea will be relieved, but the severity of the inflammation in such a case will be diminished. It will not, however, be as likely to be aborted by bleeding as by some other measures soon to be mentioned. I do not doubt that a judicious use of blood-letting may serve a good purpose in the treatment of inflammations, but I am equally confident that we have other remedies more efficient in controlling most inflammatory processes, and which, in ordinary persons not plethoric, and especially in the weak and anæmic, are less dangerous and less injurious in their ultimate effects. I refer to the neurotic and antipyretic agents which I have so repeatedly recommended. They are applicable in pleurisy. Indeed, opium may be used more freely here with safety than in bronchitis or pneumonia, as there is not the same danger of its interfering with respiration—at least it may be so used before large effusion takes place. In fact, by overcoming the pain, which in the early stage is the chief obstacle to respiration, it may materially improve that process, and is therefore doubly indicated.

When the patient is seen in the early stage of the disease, there should be no hesitation in giving a free opiate—morphine hypodermically being the most prompt method of obtaining its effects. At the same time antipyretic (or, as I have chosen to say in such cases, anti-inflammatory) doses of quinine, or of salicylate of soda should be given, combining the action of the antipyretic and the anodyne or narcotic remedies in the one anti-inflammatory effect.

The doses of quinine should be from eight to twelve or more grains, repeated once in from one to three hours, until from one to two scruples have been taken, combined with the morphine in doses sufficient to not only allay the pain, but to produce a perceptible narcotic effect.

Dr. Bartholow says: "As soon as the pleuritic inflammation begins, and the pain is a good indication, the patient should receive a full dose of quinine and morphine (ʒj quinia, and gr. ss. morphia, for an adult), and the effect of this should be maintained by smaller doses (grs. v quinia to gr. one eighth morphia) every four hours." (*Prac. Med.*, p. 316.)

This would be prompt, energetic, and efficient, but the divided and oft-repeated doses are quite as efficient, and perhaps more safe.

If the salicylate of soda is chosen, it may be given in very much larger doses than the quinine, and a full antipyretic effect should be produced.

Dry or wet cupping or leeches, mustard plasters, and fomentations or poultices will aid in procuring relief. The application of strips of adhesive plaster, so as to diminish the movements of the affected side, will often lessen markedly the pain.

The application of cold to the chest by means of cloths taken from ice-water, or by bags or bladders of ice, has been recommended, and it is alleged practiced with advantage. It has not been much ventured upon in this country, and I am unable to speak of its effects from experience. The well-known effects of cold in other forms of inflammation, and the testimony in its favor render it worthy of consideration.

If after the impression has been made by the antipyretics the symptoms still continue, eliminatives—cathartics, diaphoretics, and saline diuretics—should be resorted to, with anodynes from time to time as the symptoms may require. If effusion occurs after the local symptoms are relieved, as is apt to be the case, moderate but still efficient hydragogue cathartics will be useful in carrying off the effusion—such as the saline cathartics—Epsom or Rochelle salts, citrate of magnesia, etc.

If the pulse be firm and frequent, aconite or veratrum viride in suitable doses may be given. The diuretics applicable for aiding in the removal of the effusion, which is an important object to be aimed at, are the salines, cream of tartar, nitrate of potash, and the iodide of potassium. Digitalis is often added with advantage, especially when the heart's action is *feeble*, rapid, and oppressed.

The alkalies, and particularly ammonia, have the property of rendering exudates more liquid, and the carbonate of ammonia, given in doses of from five to ten grains, dissolved in from three to six drachms of the solution of the acetate, once in a few hours, will be applicable in the stage of exudation. Keeping the bowels free with saline laxatives will aid absorption, and these should be given as the strength will bear.

The jaborandi as a powerful diaphoretic may aid materially in diminishing effusion, and may be given when the heart's condition will allow of its use. One eighth of a grain of a salt of its active principle, pilocarpin, given hypodermically, is perhaps the best method of its administration.

Blisters repeated as may be necessary, and counter-irritation by painting the chest of the affected side with iodine are now indicated. These means aid and hasten the absorptive process. As dry a diet as possible, without inflicting suffering, should be enjoined.

If the effusion is rapid and considerable, so as to interfere much with respiration, and is not decidedly relieved by hydragogue cathartics and the other means mentioned, the aspirator should be used and the fluid withdrawn. This operation, carefully performed with a guarded needle so as not to wound the lung as it expands after the fluid is withdrawn, is a simple and not a severe one, and is often remarkably efficient in procuring relief. The profession is much indebted to Dr. Bowditch, of Boston, for his efforts some years ago in bringing this operation into general notice and favor.

In extreme cases where breathing has been almost or actually arrested, or where the heart has been oppressed, or the large vessels bent upon themselves by the pressure and displacement, so that the circulation was interfered with or even for a moment arrested; and in some instances where life seemed almost extinct, a timely operation has caused revival and led to final recovery. The trocar has long been used in cases of hydrothorax and empyema—and it often answers every purpose—but it is rather recently that the aspirator has come into use and has been so generally resorted to in inflammatory effusions at a comparatively early stage, where other means are not readily successful in their removal. Where the effusion is not great, and where from its diminution as the inflammation subsides it is presumed to be serum and not pus, the operation may not be called for; but under opposite circumstances it is required. When from the severity of the preceding and accompanying symptoms, and from the fluid remaining undiminished notwithstanding treatment, pus may be presumed to be the material, the operation should not be delayed though the quantity of fluid be not great. Pus is with difficulty disposed of by the system. It is not absorbed without disintegration, and this process is slow and uncertain, and in the meantime its presence may do much mischief. Its removal is therefore called for; and in cases where the nature of the fluid is doubtful, an operation so free from danger when carefully performed should be early resorted to.

The puncture should be made as low in the chest as possible without danger of wounding the diaphragm, not far from the axillary line, and usually just above the ninth rib. After the introduction of the needle, and as the fluid is evacuated and the lung expands, its point should be withdrawn to as near the walls of the chest as possible, so as to avoid wounding the expanding lung.

In the meantime, counter-irritation and other means must be resorted to for the purpose of overcoming any inflammatory action which may remain, and the system must be properly supported in cases of exhaustion and depression.

In a large proportion of cases early and promptly treated the dis-

ease terminates without becoming chronic and without serious consequences. In some cases, however, either from neglect, or the severity of the inflammation, or the condition of the system, the disease becomes protracted, and the more serious consequences, most of which have been referred to, result.

CHRONIC PLEURITIS.

Chronic pleurisy presents a series of phenomena and calls for remedial measures that require some further notice.

Phenomena.—When it commences in the ordinary acute form, and is accompanied by free serous effusion which lingers, some feverish action is usually present, there is a greater or less degree of dyspnœa, depending upon the amount of the effusion and the rapidity with which it has occurred ; but it is often great and the patient is unable to lie down. The breath will be short and panting, and the dyspnœa will be greatly increased on exertion ; the strength will be diminished, and various functions of the system will be disturbed.

The physical signs already described will be marked. On inspection the affected side will appear distended, which will be confirmed by measurement ; the intercostal depressions will be obliterated, and in extreme cases the spaces may be bulging. On percussion the note will be flat, and a sense of solidity and a tremulous vibration, like that produced by striking on a large bladder distended with fluid, will be communicated to the hand. On palpation a more distinct sense of fluctuation may be developed between the ribs ; and on auscultation there will be silence over the affected part. Pressure signs will be present and often marked. When the effusion is upon the right side, the liver will be depressed so as to be felt below the ribs, and the heart will be removed further to the left side.

When the effusion is upon the left side, the heart is sometimes pressed beyond the sternum to the right. The lung of the side affected will be collapsed and drawn up to its root, presenting a carnified appearance ; and if it remains long in this position, with more or less inflammatory action going on upon its surface, or in the connective tissue within its substance, false membrane may form, causing adhesions which may fix it in that position and prevent expansion when the liquid is removed. This condition sometimes causes changes in the lung, resulting in cheesy or tuberculous degenerations.

If the fluid is finally absorbed away after the lung is fixed in its position, bound by these adhesions, or restricted by false membrane upon its surface, or by adhesive bands running through its substance, or by consolidations and adhesions of its air vesicles and bronchi, etc.,

the chest walls will be retracted, the affected side will be much diminished, and the symmetry of the chest destroyed. These deplorable results I have not unfrequently witnessed in neglected cases which have applied for relief after irreparable mischief was done.

Treatment.—These consequences are to be avoided by the timely withdrawal of the fluid by the aspirator or trocar, and by the other treatment already indicated.

In the adhesive stage, where the physical signs indicate a free exudation of plastic material, its absorption may be promoted by defibrinating agents and sorbefacients, such as mercury, the salines and alkalies, the nitrate and carbonate of potash, and especially the iodide of potassium or the iodide of ammonium, and by iodine and perhaps mercurial frictions.

When a pleural abscess forms and points externally, it should be opened either by the trocar or by a more free incision, and should be managed as other abscesses—as those of the liver, for example. Sometimes a pleural abscess or empyematous collection of pus points internally, as has already been described, the matter finding its way through the bronchial tubes either by larger and more direct, or by small and sinuous openings. In such cases the lung substance is of course injured; but, unless a tuberculous tendency is present, by supporting the general strength and palliating the symptoms, a favorable result may be hoped for.

Occasionally the pus finds an exit in both directions, and an external opening in the walls of the chest communicates, through a fistulous abscess, with the bronchi. In such cases, as in other chronic abscesses, in addition to general supporting measures, injections into the abscess of alterative agents, one of the best being a solution of one grain to the ounce of water of the permanganate of potash, or other injections, such as a weak solution of iodine, or the astringent preparations of iron, etc., may be used.

℞	Liquor Iodini Comp.....	ʒj
	Aqua	ʒjv

M.—For injection.

℞	Chlorate of Potash.....	ʒj-ʒjss
	Water	Oj

M.—Injected warm. Or,

℞	Salicylic Acid,	
·	Borax	āā ʒj
	Water	Oj

M.—For washing out the cavity.

Better still often is

℞ Permanganate of Potash.....grs. xx
 Water..... Oj
 M.

These openings of the chest and injections are now advised to be practised with antiseptic precautions, to prevent the admission of germs.

A good diet, cod-liver oil, and various tonics, may be required.

When there is pus in a free state in the chest (empyema) it sometimes finds its way out by an external opening through the walls, by the usual ulcerative process. In one instance which fell under my observation the pus had made an opening between the ribs in the axilla, and had traveled down the arm, pointing near the elbow, and large quantities of it were thus discharged from the chest. A counter-opening in the lower part of the chest between the ribs gave exit to a large flow and arrested the discharge from the arm. The patient, a previously healthy farmer, made a final recovery with but little impairment of the lung.

Though in vigorous subjects chronic pleurisy with suppuration is often recovered from, yet in those who have a predisposition to phthisis from heredity or other causes, or who are debilitated or under unfavorable influences, the development of consumption is not uncommon; and this sometimes occurs where no such predisposition can be traced, where the previous condition of health was good, and where the hygienic influences are favorable.

The prevention of the protracted continuance of pleurisy is, therefore, a matter of great importance, and when it becomes chronic every means should be resorted to for arresting its progress and for warding off physical degenerations.

In empyema nothing can be more important than evacuation of the pus, and the aspirator furnishes the simplest and least disturbing method. The repetition of the operation is frequently called for, and, in some cases, an opening into the chest with a scalpel, and the introduction of a drainage tube, is the preferable mode of procedure. It is proper to state that occasionally, though rarely, the operation of aspiration, or paracentesis thoracis, has been followed by shock and serious consequences, and even death apparently as the result of the operation. It is not therefore advisable to draw off a large quantity of fluid at one time; and it is thought safer to repeat the operation in a few days, rather than produce too sudden a change at a single sitting. Under the debilitating effects of a large production of pus,

careful supporting means are demanded. As good and liberal a diet as the stomach will digest, and quinine, iron, mineral acids, etc., are called for, and the most favorable hygienic conditions of pure air, sunlight, and proper food, must be secured.

SECONDARY PLEURISY.

Pleurisy is not unfrequently secondary to other diseases. It not only occurs from extension of the disease in pneumonia, phthisis, and bronchitis, but also from Bright's disease, pyæmia, rheumatism, gout, erysipelas, and various cachectic conditions. It is also not unfrequently the result of traumatism, of blows upon the chest, of fractured ribs, penetrating wounds, etc. In most of these conditions the complications render the disease more grave than in ordinary cases of the simple form.

In most cases of pneumonia there is more or less pleuritic complication, and the pain in this affection is usually largely from the inflamed pleura. It requires no special modification of the treatment, which is applicable to the cases of pneumonia where no pleuritic complication is discoverable. In these ordinary complications there is not often much effusion, though in lobar pneumonia adhesions not unfrequently result.

In tuberculosis of the lungs pleuritic inflammation is very frequent. It is the cause of the stitchy pains so common, and in the later stages when cavities form near the surface, pleuritic inflammation and adhesions prevent these vomicæ from discharging their contents into the cavity of the pleural sac, and also prevent the frequent occurrence of pneumo-hydrothorax. Tubercles are not unfrequently deposited, and sometimes primarily, in the pleura, which excite inflammation in it, as in the peritoneum. The treatment required in these cases will be the same as for the accidental symptoms in tuberculosis, and will be referred to when this affection is considered. A rupture of a tuberculous cavity, and the discharge of its contents into the pleural sac will commonly cause extensive inflammation of that membrane, and contributes to the production of the fatal result so generally following such an accident. Anodyne and palliative treatment will be called for. Free doses of quinine and morphine will tend to check the inflammation.

When it is complicated by bronchitis, as in the description of the pathology of that disease was seen to be the case, interstitial pneumonia exists at the same time, and no special treatment for the pleuritic complication, which is usually slight, will be required.

In Bright's disease of the kidney the serous membranes generally are irritated, and a slow but persistent pleuritic inflammation and effusion are likely to occur.

In these cases the effusion is apt to be bilateral, and to shade off into simple dropsy.

When decided pleuritic inflammation occurs the case is serious, but the principal treatment must be directed to the relief of the uræmic condition. It will be more particularly referred to in describing Bright's disease.

In pyæmia and other cases of blood poisoning, if the pleura becomes seriously inflamed, a fatal result is likely to occur; but no treatment different from that required for the original disease, except local applications—fomentations, counter-irritation, etc.—will be demanded.

The same may be said with reference to its occurrence in other diseases, as small-pox, scarlatina, etc.

In the treatment of traumatic inflammations of the pleura, profuse bleeding was formerly practiced, and was thought to be necessary and very useful. That bleeding will sometimes be called for I do not doubt, but I know of no reason why it should be more required in traumatic than in idiopathic cases, in similar conditions of the general system, and presenting similar symptoms. The same principles of treatment apply in both. In the diathetic cases, however, the peculiar condition of the diathesis will largely influence the treatment.

HÆMOTHORAX.

Hæmothorax is an effusion of blood (hemorrhage) into the cavity of the pleura. It is commonly traumatic—from stabs or penetrating wounds of some kind—but may arise from a cancerous tumor involving the pleura, from the rupture of an aneurism, and from rupture of the pleura in pulmonary apoplexy and some other conditions.

The *Symptoms* will vary according to the cause of the bleeding and its extent. Dyspnœa will usually be among the early symptoms. There will be evidences of the loss of blood, and evidences of inflammation and effusion will follow. The presence of blood in the pleural cavity generally excites decided inflammation, accompanied by serous, and not unfrequently by purulent effusion.

The *Diagnosis* is to be made by observing the cause, and by the dyspnœa and evidences of loss of blood, pallor, debility, faintness, etc., and by the physical signs; and later by the evidences of inflammation which will follow.

If the hemorrhage is great there will be enlargement—bulging in the most dependent part of the chest, dulness or flatness on percussion, and silence on auscultation; and these conditions will come on suddenly. The usual evidences of inflammation will present themselves—pain, fever, perhaps a chill; and when effusion takes place the chest will be further expanded, and the dulness on percussion and silence on auscultation will extend over a larger space.

In effusions in the chest the amount of dyspnœa does not depend alone upon the amount of the effusion, but also upon the suddenness of its occurrence. With the same, or even an increased quantity of fluid in the chest, the feeling of dyspnœa will diminish as the patient becomes accustomed to its presence, and as the unaffected lung expands and becomes more active in its function to meet the emergency.

Hence in hæmothorax the dyspnœa will often be great at first, and abate afterward, though effusion rather than absorption is taking place. In such cases a physical examination, and particularly mensuration, early and repeatedly resorted to, will correct the impressions which the symptoms alone might give.

The *Prognosis* in hæmothorax will depend upon the character of the wound or other cause that produced the flow, upon the extent of the loss of blood, upon the amount of inflammation following, and the endurance of the patient. It is, however, a grave accident and often fatal.

The *Treatment* of hæmothorax may be divided into that for arresting the flow of blood and relieving its immediate consequences—the obstruction of respiration and arrest of the heart's action by syncope or asthenia; and that for the inflammation and its consequences which will be presented in case the first danger is passed.

The treatment for the first object will consist in keeping the patient as quiet as possible, in a cool, well ventilated place, in applying cold to the chest, giving cold drinks and administering hæmostatics—ergot, and perhaps other astringents—when the hemorrhage is from small vessels. Opium, by calming excitement, often produces more hæmostatic effect than other means, while it also relieves pain and the distressing sense of dyspnœa. It should not be carried to too great an extent, as it might diminish too much attempts at respiration and lead to asphyxia. If the amount of blood be so excessive as to cause danger of this condition (though if in one pleural cavity only this is not likely to occur), the aspirator may be used at once to diminish to some extent its quantity. Otherwise the blood should be allowed to remain until the hemorrhage has ceased and the immediate danger of its recurrence is passed, as the pressure of the blood generally tends to stop the flow.

If there is danger of fatal syncope or asthenia, the heart's action must be kept up by cardiac stimulants, by warmth to the extremities, warm nourishing broths, etc.; but these means should not be early resorted to while there is danger of the continuance of the bleeding, unless the depression is great and the danger from that source is imminent.

The inflammation which follows should be treated as in other cases of pleuritis, allowance being made for the loss of blood which has occurred, and for whatever complicating circumstances may be present.

The serous or purulent effusions, which are almost sure to follow, must be relieved by aspiration or paracentesis as in other cases, and repetitions of the operation will often be required.

The causes that produce hæmorthorax must be taken into the account in treating it and in judging of its severity. They are generally serious, and for this reason the prognosis in hemorrhage into the chest is so grave. The prognosis, as well as the treatment, will, however, depend upon the particular cause, upon the amount of blood lost, and the character and degree of the inflammation induced. In some cases very large quantities of pus are produced, which, together with the previous loss of blood and the other results of the lesion, will cause comparatively rapid sinking, after the more immediate danger from the hemorrhage and suffocation has passed. Active supporting measures are then essential, good food, quinine and iron, and other tonics and stimulants.

PNEUMOTHORAX.—PNEUMOHYDROTHORAX.

Pneumothorax is air in the cavity of the chest. Distention of the pleura with any substance, solid, liquid, or gaseous, causes collapse of the lung and diminution of its breathing capacity in proportion to the amount of matter in the cavity. When air is freely admitted into this cavity, either through the thoracic walls or through the bronchi, lung substance, or the pleura pulmonalis, the lung is completely collapsed, and is not inflated when the chest expands in the effort at respiration. In such cases the lung upon the side affected is rendered completely useless; and if both sides are similarly involved, death will be immediate by apnœa. A knowledge of the mechanism of respiration renders any explanation of this occurrence unnecessary.

Air may obtain access to the pleural cavity in several ways, and the *causes* of pneumothorax are therefore various. A wound through the walls of the chest sufficient to freely admit the air, causes immediate

collapse of the lung if no adhesions exist, as the air passes into the pleural cavity. Perhaps the most frequent cause is the opening of a tuberculous vomica or pulmonary abscess into the cavity by an ulcerative process through the pleura. Pneumothorax, now a rare disease, would from this cause become a much more frequent one were it not for the adhesions which so generally form between the pleural surfaces when there is an abscess near the surface of the lungs.

Rupture of the emphysematous air vesicles may also cause the condition, as may gangrene of the lung or abscess of the bronchial glands opening into the bronchi and pleura. Ulceration of the œsophagus through into the pleural sac, and other rare accidents may operate as causes; and besides, gases may be secreted, it is thought, in the cavity, or at least may be produced from decompositions within it, and cause the disease without the introduction of the external air.

When it occurs in the course of phthisis, gangrene of the lungs, abscess of bronchial glands, etc., the symptoms are a sense of rupture or giving way, severe pain, great shock as of internal injury, and extreme dyspnoea when the lung is entirely collapsed. Sometimes, especially if the opposite lung be diseased, collapse of the system and death are sudden.

In case of survival for any length of time, especially where the disease is the result of an abscess, there will be fluid in the cavity, gravitating to the most depending part, and the condition of pneumothorax is present.

In case of rupture of bladders of air vesicles in emphysema, the symptoms may develop more slowly, and possibly in this and some of the other conditions the accumulation of air may be limited and the collapse of the lung but partial, and the symptoms will be then less extreme.

Considering the causes producing it, and the severity of the symptoms, the *Prognosis* is unfavorable, though cases may linger long and some may recover.

The *Diagnosis* is to be made by observing the symptoms and probable causes producing it, and more positively by the physical signs.

On *inspection*, the affected side is usually distended, as each violent effort at inspiration forces more air into the cavity than flows out in the less powerful expiratory acts. If the opening be very large and free, either through the external walls or through the bronchi, so that the air passes out readily in expiration, the size of the chest may be normal, and the motion may be free. In other conditions the motions may be restrained. On *percussion*, the hollow tympanitic sound is marked and characteristic. It will be loud, sonorous, prolonged, and

drum-like. The pitch will vary according to the tenseness from the distention—higher when more tense. When fluid is present in the cavity, as is usually the case, there will be dulness or flatness at the most depending part—the line between this and the sonorousness varying with the position of the patient.

On *auscultation*, if there be a free flow of air in and out of the cavity in the expansion and contraction of the chest in the respiratory movements, there will be likely to be an amphoric respiration sound, sometimes loud, ringing, and musical, varying in pitch according to the size of the opening through which the air passes, and modified in quality by the size of the cavity and the condition of the walls, but resembling blowing into or over the mouth of a bottle. All the sounds in the chest—those of the heart-beat, the voice, or cough, or of râles—will have a metallic ringing quality.

Should any further signs be required, succussion or moving the body suddenly might develop a splashing sound of fluid and air together; and should a fluid be dropping down from an opening through the retracted lung into the cavity below, or should sudden movements occur, metallic tinkling may be heard.

The history of a case of pneumothorax, and the symptoms and signs that have been described would seem sufficient to distinguish it from every other affection; but large cavities in phthisis, much dilated bronchi, and emphysema with pleuritis, and a limited effusion into the chest, have resemblances to pneumothorax and pneumohydrothorax. Indeed, pleuritic effusion—fluid in the lower part of the chest with a compressed lung floating upon it—gives flatness on percussion below, and a degree of tympanitis above, which somewhat resemble pneumothorax. Amphoric respiration, splashing, succussion sounds, and all the metallic ringings will, however, be absent. In none of the cases of resemblance do the symptoms come on with the same suddenness, the dyspnœa is not so extreme, and the percussion sound is not so loudly and distinctly drum-like.

When the distention is great, the heart may be pressed out of its proper position, and may be embarrassed in its action by the bending of the large vessels upon themselves.

The *Treatment* must be modified by the causes, the accompanying conditions, and the symptoms present.

When pneumothorax occurs in phthisis from the rupture of a vomica, or from any similar internal cause, the pain, dyspnœa, and shock may be mitigated by anodynes and stimulants—opium, in some of its forms, being the chief reliance. The *Quebracho Bark* has lately been recommended as relieving the sense of dyspnœa, and increasing oxygenation when there is a limited supply of air. A fluid extract is

used, of which the dose is from twenty minims to a fluid drachm. The testimony in favor of this article, in dyspnœa from various causes, is sufficient to justify further trials of it, but not to establish its reputation or determine the circumstances in which it is most useful and safe. The patient should be placed in the most comfortable position—should have free, fresh air; and condensing the air, or rendering it more rich by the addition of oxygen, would tend to prevent the asphyxiated condition and relieve the sense of dyspnœa.

When there is great distention of the side, increasing the dyspnœa by pressure upon the other lung, or obstructing the circulation of the blood through the heart and large vessels, a trocar might be introduced and a flow of air permitted through the wall of the chest. This opening, of course, unless closed during inspiration, would allow the air to pass in as well as out, but the closure might be effected by the finger of an attendant. If, however, free exit to the air be allowed, though ingress be admitted, the distention and internal pressure will be diminished.

In case of pus accumulating in the chest with air, it should be evacuated, and a drainage tube inserted; and the cavity might require to be washed out and injected by some antiseptic fluid, as in cases already mentioned.

Congestion and œdema of the sound lung sometimes occur from arrest of the circulation in the collapsed one. Venesection was formerly recommended for the relief of this, and in vigorous patients, where the case is traumatic, this remedy may be required; but in feeble patients, ligating the extremities, and retaining the blood there until the system has had an opportunity to adjust itself to the new conditions, may bridge over the chasm. It should be borne in mind that, in the operation of paracentesis thoracis, without proper care air may enter the chest when the fluid is withdrawn, and produce the accident of pneumothorax. There is a particular tendency to this, when adhesions prevent the ready expansion of the lung to occupy the space of the evacuated fluid. When air thus enters, the opening of the canula must be at once closed by the finger during inspiration, though a flow of fluid may take place during expiration. But the canula must of course be withdrawn, and the opening it has made through the walls closed, as soon as the fluid ceases to flow in expiration.

In pneumothorax produced by a wound of the walls of the chest, the opening must be closed; and if further inflow be prevented, and the symptoms palliated, the air may be absorbed and restoration of the lung to its expanded condition may occur. In any case, if inflammation and effusion follow, they will require treatment on the same principles as in other cases of such inflammation.

HYDROTHORAX.—DROPSY OF THE CHEST.

The term hydrothorax, literally meaning water in the chest, is applied when a serous fluid is in the cavity of the pleura, which is not the result of inflammation of that membrane. It arises from the common causes of dropsy, a subject more fully discussed elsewhere. The two most frequent causes of this form of dropsy are obstructive disease of the heart, and Bright's disease of the kidney. It is generally bilateral, as the causes usually operate upon both sides alike.

The fluid of hydrothorax has usually a pale sea-green color, is transparent, but it sometimes coagulates, when exposed to the air, by the formation of very fine fibres arranged in a reticulated form. The pleural membrane is normal in pure dropsy, with the exception of a blanched or soaked condition from the presence of the fluid.

In what is called latent pleurisy, approaching dropsy of the chest, the membrane is thickened, infiltrated, and often covered by a semi-plastic exudate. But this is a pleuritis, rather than a simple dropsy.

The *symptoms* are dyspnoea, often extreme, but in proportion to the amount of the fluid and the suddenness with which it is effused. Frequently there is inability to lie down, with cyanosis and other signs of obstructed respiration. There will be no symptoms of inflammation, either preceding or accompanying the effusion, but there will be evidences of some other pathological condition of which the dropsy is a symptom. Dropsy of other cavities and general anasarca are likely to be present at the same time, and, not unfrequently, hydrothorax is complicated with marked pulmonary congestion and œdema. The dyspnoea will then be aggravated, and cough and expectoration will be present. A short, dry cough often occurs in simple hydrothorax.

The physical signs are those of fluid in the chest, from whatever cause. The fluid is generally bilateral, is always free in the cavity, gravitates to the most depending part, and changes its relative position with the change in the posture of the patient.

On inspection there will be enlargement of the lower part of the chest, with obliteration of the intercostal depression when the quantity of fluid is large; there will be diminished mobility of the lower part of the chest, and perhaps increased mobility above.

Percussion will give dulness or flatness, according to the amount of effusion in the lower part of the chest, with resonance above, the line between the two varying with the position of the body. Palpation will show diminution or absence of vocal fremitus in the same

situation, and, on auscultation, there will be silence over the place of the fluid.

The disease should be distinguished from pleurisy with effusion, from pulmonary and bronchial inflammations and consolidations, from emphysema, from obstructive cardiac disease with pulmonary œdema, from enlargement of the liver, and from cancerous and other morbid growths in the chest.

It will be distinguished from pleurisy by the history of the case, by being bilateral, and by the presence of other pathological conditions which account for the dropsy; from bronchial and pulmonary inflammations by exclusion in consequence of the absence of their essential symptoms and signs; from emphysema by the diminished instead of increased resonance on percussion, and by the bulging below instead of above, by the shortened instead of lengthened expiratory movement, and by silence instead of respiratory sounds in the lower part of the chest; from pulmonary œdema by the presence in the latter of moist crepitation and bronchial râles, by dulness rather than flatness on percussion, and also by a frequent moist cough and watery expectoration instead of an occasional dry, hacking cough.

It is to be distinguished from enlargement of the liver by the following conditions: it is upon both sides, the line of flatness on percussion is nearly horizontal instead of being convex above, and changes with changes in the position of the body. It is distinguished from tumors in the chest by the latter being unilateral and fixed. Effusion not unfrequently occurs in connection with morbid growths which may obscure the physical evidence; but in all cases the history and the concomitant diseases will throw light upon the subject.

The prognosis in hydrothorax will depend upon the character of the disease of which it is a symptom. When it depends upon organic disease of the heart or of the kidney, or upon malignant anæmia, etc., it is, of course, very grave. It may often be relieved, and sometimes permanently, though the disease of which it is an expression may continue; but, unless the cause is removed, it usually returns.

As hydrothorax is a symptom of various pathological conditions, such as disease of the heart or kidneys, anæmia, obstructed circulation, etc., its treatment must be directed chiefly to these. As in other forms of dropsy, hydragogue cathartics and diuretics or diaphoretics will often carry off the water completely or materially diminish the amount; but when they fail, or are inapplicable from debility or any other cause, and the dyspnoea and other symptoms arising from the presence of the fluid are severe, aspiration or paracentesis is called for. The operation is likely to be followed by reaccumulation, and its repetition may be required.

For the treatment of the affections of which the dropsy is symptomatic, the reader is referred to the articles on diseases of the heart, kidneys, etc.

The pleura is sometimes the seat of primary tubercular deposits, and of irritation or a slow grade of inflammatory action, with serous effusion, occurring in both sides of the chest without the usual preceding history of an ordinary pleurisy, or evidences of those other affections that usually cause dropsy. The pleura is often also secondarily affected in pulmonary tuberculosis; but these affections of this membrane and their relations to phthisis will be considered in other connections.

ASTHMA.

The term asthma is used both as indicating certain symptomatic phenomena and as the name of an idiopathic or special disease.

In the former sense it signifies a spasmodic difficulty of breathing, from whatever cause arising. In the latter sense, as a distinct disease, asthma is a neuropathic affection manifested by spasmodic contractions of the unstriped muscles of the bronchial tubes, which renders respiration difficult and labored; and it comes on in paroxysms at intervals of various lengths, generally in the night, and with remissions of the severity of symptoms, usually continuous from a few hours to one, two, or several days, and terminating in comparative health.

As a symptom, something like the regular asthmatic breathing may occur in hysteria and other nervous affections; in pressure by enlarged bronchial glands upon respiratory nerves; or in consequence of an irregular or imperfect supply of blood to the lungs, in which latter case it is called hæmic asthma. This may occur in anæmia and some other blood affections, and in diseases of the heart or large vessels—pathological conditions which, with their symptoms, will be considered in other connections.

As a specific idiopathic disease asthma is here to be considered.

Pathology.—Its essential Morbid Anatomy, if it has any, has not been ascertained. As death very seldom occurs from uncomplicated cases, opportunities for such investigations are rare. It occurs quite independently of organic lesions of the lungs, bronchi, or heart, though it is often connected with such diseases, especially with bronchitis. The immediate pathological state is a spasmodic contraction of the muscular tissue of the bronchial tubes, caused by some peculiar excitement of the nerves supplying them; and this in turn may be produced either by some central morbid state, or by a peripheral impression and reflex action.

Leyden reports that he has found in the expectoration of asthma brownish cells undergoing granular degeneration, between which are small, pointed, octahedral crystals, some readily seen by the microscope, but others so small as to require special contrivances to discover them. They have been examined by others, and are regarded as composed of a material analogous to mucin. Leyden is of the opinion that these minute crystals irritate the terminal filaments of the vagus nerve, and by reflex action induce spasm of the bronchial muscles.

It is probable that no one proximate cause is responsible for the production of asthmatic phenomena, but that various special conditions are capable of exciting them.

The repeated and powerful action of the bronchial muscles may lead to hypertrophy of the muscular coat, and to a general thickening of the walls of the tubes. The latter, however, is generally due to inflammatory complications—to chronic bronchitis, which so often accompanies it. Occasional alterations have been found in the nerves concerned, but not with sufficient constancy or in a sufficient number of cases to establish a definite relation between any such lesions and the symptomatic phenomena.

The bronchitis, so frequently present in the disease, is often the result of the repeated asthmatic attacks, though a bronchitis arising from other causes may excite a paroxysm of the asthma. More or less emphysema very often is present in old cases of asthma, generally produced by the asthmatic attacks. The violent inspiratory efforts, forcing the air into the vesicles, with a less free outflow in the less forcible expirations, tend to distend them and to produce the emphysematous condition.

Causes.—The essential cause of asthma is an asthmatic state whose nature is unknown, and which is recognizable only by the phenomena of the disease.

It is thought to be sometimes hereditary, and though the constitutional peculiarity favoring its development may be transmitted, the influence of heredity is not particularly marked in its production. It is more common in men than women, and may occur at any age, from childhood to advanced life. It sometimes alternates with other nervous affections, and sometimes with diseases of the skin.

There are various exciting causes that produce paroxysms in those subject to the disease. Thus, exposure to cold and wet, derangements of the stomach, certain articles of food, inhaling the powder of ipecacuanha or other substances, sleeping upon feathers, even depressing emotions, may bring on an attack. In the case of a medical gentleman which has come under my observation, the odor of a horse excites

a paroxysm. This is so constantly the case that this animal has to be avoided to such an extent as seriously to interfere with the physician's visits to distant country patients.

Climate and locality have a very important and often a very striking influence, but this influence is only to be determined by experience in each individual case. The same locality does not affect all alike. A person specially liable to attacks in a particular locality may be relieved by going to a place where another asthmatic is specially subject to attacks. Two asthmatics exchanging residences may both be relieved.

A change from the city to the country, or the reverse, is well known to often procure relief, or from the seaside to an inland situation, from a valley to a mountain, or from a moist to a dry situation. A removal from one place to another where the appreciable climatic conditions are similar, will often be attended by marked changes in the liability to attacks. There is no rule on the subject, though in some regions there is a remarkable exemption from the disease.

It is said that the climate of Colorado affords almost complete security against asthma to its permanent inhabitants; but whether longer experience will confirm the statement, remains to be determined.

In several instances within my knowledge the analogous disease of "heaves" in horses, coming on in south-eastern Michigan, has been suddenly and permanently cured by the removal of the animals to the prairies of northern Illinois. The exemption of horses from the disease in that locality has been attributed to the "rosin weed," which abounds there and is often taken with their food, and an extract from this plant has been suggested and used as a remedy for asthma. In the instances referred to the horses were relieved before the "rosin weed" could have been taken, and the extract prepared from it has not proved successful as a cure for asthma. The effect upon the horses must be attributed to some other cause; but experience has not been sufficient to determine what it is, or whether it produces the same effect in all cases, or sufficiently often to establish a rule.

Symptoms.—The symptoms of asthma are marked and characteristic, and its course, though variable in different cases, has striking features. A paroxysm usually comes on without special premonitory symptoms, though many asthmatics can, by their sensations, foretell an attack. Some have a sense of depression, while others experience an unusual feeling of buoyancy. In some cases a slight degree of asthmatic breathing occurs for some time before a severe attack. More are seized in the latter part of the night than at any other time during the twenty-four hours. The patient awakens, sometimes from a sound

sleep, but sometimes after one which is disturbed by a half-conscious sense of suffocation, with a feeling of severe dyspnœa, which often causes him to rise, remove every restraint from his chest, and rush to an open window for air. His inspirations are frequently prolonged, though at other times shortened, and are effected with great effort. His expirations are more constantly and decidedly prolonged, and both inspiration and expiration are accompanied by wheezing sounds, audible without the application of the ear to the chest. In some cases there is a tendency to pass a free quantity of colorless urine. The sense of suffocation, in a severe and typical case, is very intense. With open mouth and distended nostrils the whole energies of the patient seem expended in the respiratory efforts. He may bring the muscles connected with the arms into action to assist in the expansion of the chest. The expression of the face, especially in the earlier attacks, is one of appealing anxiety. On examining the upper air passages with the laryngoscope, the mucous membrane is found injected. The chest cavity is expanded, as more air is taken in than is thrown out, at least for a time; and during inspiration, as the diaphragm descends and the ribs are elevated and the cavity of the chest tends to be expanded more rapidly than the air can pass in through the spasmodically contracted tubes, the suprasternal notch and the intercostal spaces sink by the external atmospheric pressure, notwithstanding the general expansion of the lungs. In this labor and distress perspiration often breaks out over the face, chest, etc., while the extremities may be comparatively cold, and the pulse small and weak. From the great descent of the diaphragm the abdomen protrudes, giving the appearance of abdominal flatulence.

On percussion the chest is everywhere sonorous, and on auscultation, bronchial râles, sibilant and sonorous, will everywhere be loudly heard.

By these symptoms and signs, and by the history after paroxysms have taken place, the diagnosis is easily made.

The course of the disease is various and the prognosis uncertain.

Though few or none die from the dyspnœa of simple uncomplicated asthma, it may nevertheless shorten life by uniting with other affections. While the prognosis is good as to the direct destruction of life by the disease, it is not good as to a complete cure.

In many cases it is emphatically a constitutional condition, and paroxysms with more or less frequency and severity, and often with bronchitic and emphysematous complications, continue to occur during a whole lifetime. In other cases great relief is obtained by change of climate and locality, and not very unfrequently without such change the paroxysms cease to recur. The severity of the symp-

toms and the length of a paroxysmal attack vary exceedingly, from slight difficulty of breathing occurring but seldom and continuing but a short time, up to almost continual suffering with long exacerbations of intense distress.

Spontaneous and radical cures are more likely to occur in cases commencing in infancy. About the period of puberty a change in the disease, as well as in the general organism, is apt to take place; but in a majority of cases, at whatever period it occurs, the disease, or at least a liability to it, continues through life.

Old asthmatics acquire often a peculiar and well-marked physical conformation. They frequently have thin, furrowed cheeks, high shoulders, the body bent forward but the head thrown back, the upper part of the chest dilated and the lower part compressed, particularly in the lateral direction.

Though few asthmatics have consumption, asthma is by no means an effectual protection against the latter disease. The chronic bronchitis, so often a complication of asthma, may be accompanied by extension of disease to the lung substance and by degenerative and wasting changes. Asthmatics, especially if much emphysema has occurred, bear diseases tending to produce apnœa much worse than those free from these affections. More heart power is required to carry on the pulmonary circulation when any impediment exists in the lungs, and the heart is more likely to be inadequate to the task. According to Liebermeister, typhoid and other low fevers are much more likely to prove fatal in patients having chronic pulmonary affections that require more cardiac force to propel the blood through the lungs.

TREATMENT OF ASTHMA.

The treatment of symptomatic spasmodic breathing, often called asthmatic, must be largely directed to the original morbid state producing it. In hysteria and other nervous affections, in cardiac or blood diseases, and where the asthmatic symptoms are produced by reflex irritations, these several morbid causes must if possible be removed. The dyspnœa, however, can often be directly and materially relieved by various neurotic remedies, among which, in hæmic cases especially, opiates are most efficient. Quercacho may be tried in these cases. In hysterical cases the remedies best adapted to this condition will be most effectual; and when reflex irritation from the stomach, the bowels, the genital or other organs is the cause, treatment adapted to the removal of these conditions will be required, while palliation may be effected by remedies which diminish reflex

irritability. Besides opiates, chloral hydrate, chloroform, and various other anodyne, antispasmodic, and narcotic substances may be brought into requisition.

The treatment of specific idiopathic asthma is divided into that which is abortive or palliative of the paroxysms, and that intended to prevent their recurrence.

Various remedies, but not the same in all cases, and even not the same in an individual case at all times, will often promptly arrest or materially cut short the paroxysms; and where this is not accomplished the severity of the symptoms may be greatly diminished.

Nauseants and emetics have long been used for relief of the symptoms, and are often quite efficient. Ipecacuanha, tartarized antimony, and lobelia are the articles of this class which have been most employed. They are, however, distressing in their effects, especially the latter two, and are now very properly much less used than formerly. When, however, bronchitis is present with exudates that are with difficulty expectorated, these remedies may be strongly indicated, and carried to the extent of vomiting, especially in children, often procure great relief. As a rule, ipecac. should be preferred as less depressing, though it may not be in some cases as efficient as lobelia.

In many cases a full dose of morphine will promptly relieve the very distressing dyspnœa, and will sometimes arrest the paroxysm. In others it will not only fail to arrest the paroxysm but will afford only slight relief to the dyspnœa; and Salter, whose writings on the disease are so frequently referred to, discourages its use except in complicated cases. My experience, however, testifies to its great usefulness, and its applicability to many cases.

The inhalation of chloroform, while the patient is under its immediate influence, greatly relieves the dyspnœa, but the relief is usually exceedingly temporary, the symptoms returning as soon as the inhalations are discontinued. On the whole it is of very little benefit, and may do harm directly or by interfering with other remedies. Almost the same may be said of the nitrite of amyl, though sometimes the prompt relief its inhalation affords is quite permanent, and generally is longer than that afforded by chloroform. It is, however, an article not devoid of danger, must be used with great caution, and has disappointed the hopes of its great value in this disease which a few years ago were entertained.

Chloral hydrate will sometimes procure decided relief, but it often fails, is not devoid of danger, and should be used with great caution, if at all. Moderate doses, ten to eighteen grains, given by the stomach, at the same time that from a tenth to a sixth of a grain

of morphine is given hypodermically, are said to be efficient often in relieving the paroxysms.

The bromide of potassium is much less objectionable, but is frequently inefficient. Where, however, it procures relief, its use is to be commended. Pretty free doses—from one to two or three scruples—must be given to produce much effect.

I know of no one remedy more likely to arrest a paroxysm of asthma than a full dose of quinine. I can fully join in the statement of Prof. Flint in which he says: "The author has known of repeated instances in which full doses of quinine, that is, from twenty to thirty grains to an adult, have promptly arrested the paroxysms."* I have more frequently given it in doses of from six to ten grains, repeated from three to four times at intervals of from one to three hours, commonly adding to the first dose a quarter of a grain of morphine, and sometimes a similar or smaller quantity to the third or fourth; and my experience has taught me to expect the greatest and most positive relief from this treatment. I have, however, noticed that some cases promptly relieved by the first use of this remedy, failed to be as favorably affected by the same agent in subsequent attacks.

Stramonium, particularly, and the other vegetable narcotics often succeed in procuring more or less relief, but I have seldom used them of late by the stomach.

Inhalation of the smoke of burning coarse paper saturated with nitrate of potash, prepared by dipping the paper in a strong solution of the salt and drying it before use, has long been in favor, and in most cases produces more or less relief. This may be resorted to while other means are being used and the chamber of the patient may be filled with the fumes. Smoking the leaves of stramonium in a common tobacco pipe—or smoking tobacco until its sickening narcotic effect is felt in those not accustomed to its use, will often relieve the dyspnoea.

A compound which for years I have recommended, and which some patients keep constantly about them and use with the greatest satisfaction, is prepared by pulverizing together equal parts of the leaves of stramonium, nitrate of potash, and wheat flour, wetting and making it into pastilles of convenient shape and size which are dried in an oven but moderately heated. If one end of the pastille be ignited it will burn slowly, giving off abundant fumes, which by holding the pastille in a proper position may be inhaled until relief or a proper narcotic feeling is experienced. This of itself will often afford satisfactory relief; but in severer cases may be used in conjunction with

* Clinical Medicine, p. 142.

other measures. A great variety of pastilles, cigarettes, and medicated papers are sold as secret or proprietary medicines for fumigation. They are composed variously of stramonium, belladonna, poppy, tobacco, grindelia, or their active principles mingled with nitrate of potash, and some of these are well adapted to the relief of particular cases.

Grindelia Robusta, a remedy which has now been in use a few years, has secured the confidence of some who have used it, and I have seen it produce in some cases prompt and decided relief. Half a drachm or more of the fluid extract may be repeated every hour or two until its effects are realized. It is sometimes useful as a fumigant. The Quebracho is here worthy of further trial. A cup of strong coffee will relieve some cases, and various other remedies will have more or less effect.

A selection of remedies must be made according to the physician's judgment, largely influenced by the effects of previous treatment in each individual case. Different cases are differently affected by the same remedies, and hence so many remedies have been named.

Inhaling compressed air, and expiring into rarefied air by the method referred to for bronchitis, is spoken of very favorably by some of the German writers, especially when the disease is complicated with bronchitis; and as the air taken into the lungs is limited, if enriched by additional oxygen the cyanotic condition is relieved.

Cases are reported of favorable effects from galvanization of the pneumogastric nerves by placing the positive pole beneath the mastoid process, and the negative to the epigastrium. It has, however, failed in other instances, and nothing is established as to its general value or as to the particular cases to which it is applicable.

The more radical treatment for the prevention of the attacks, and for removing a tendency to their recurrence, consists chiefly in the avoidance and removal of the causes known to excite the asthmatic phenomena. Bronchitis, which so frequently complicates asthma, often producing and always when present aggravating attacks, requires special attention. Its treatment in these cases will not materially differ from that applicable to other cases, where similar symptoms are presented.

It gives me pleasure to again quote a remark from Prof. Flint, which corroborates my own opinion of the value of the long-continued use of the iodide of potassium in modifying the general condition, especially where bronchitis is present, and preventing the recurrence of paroxysms. He says: "The iodide of potassium, in some cases, is a remedy of marvelous potency in the prophylactic treatment. Some patients are rendered quite secure against attacks by the per-

sistent use of this remedy, and it may be continued in moderate doses for an indefinite period, if well tolerated." *

Whether this remedy produces its chief effects by removing the bronchitis and thus preventing reflex irritation, or whether it acts upon the more central nervous system, modifying its conditions, we may not be able to state, but its utility in many cases is attested by experience.

The alterative and tonic effects of arsenic sometimes appear to be useful in preventing attacks, and when the disease is accompanied or alternated with cutaneous affections, a course of Fowler's solution would be indicated. It may be combined with other remedies as other indications present themselves. It is often more efficient in combination with iodides. In debilitated cases quinine and iron are indicated.

Attention to the diet in asthma is frequently of great importance. No positive rules can be given as applicable in all cases, for asthma is nearly as capricious in reference to diet as to medicines and climate. Avoiding those articles which are found to disturb the stomach, and are with difficulty digested, is important, and bulky articles are liable to produce attacks. The diet should be plain, simple, moderate, but sufficient, regularly taken, and consisting, as a rule, in a considerable proportion of animal food.

When other means fail, a change of residence should be considered. No positive rules can be laid down on this subject, as will be gathered from what has already been stated; but in general, perhaps, elevated situations, with a dry and pure atmosphere and uniformity of temperature, are to be chosen as residences for asthmatics. Quite opposite conditions, however, in some cases seem to agree better, and only experience in each individual case can determine positively the better place.

PULMONARY ŒDEMA.

Œdema of the lungs signifies the effusion into the lung substance of a serous fluid which occupies the alveoli, the intervesicular connective tissue, the lymphatics, and the perivascular lymph spaces.

An œdematous condition of the lungs not unfrequently accompanies other morbid states, and is sometimes the immediate cause of death in various acute and chronic diseases.

In œdema of other parts of the body, the aqueous effusion is into the areolar or connective tissue. In that of the lungs, the principal

* Clinical Medicine, p. 143.

effusion is into the air-cells. In this the air is excluded in proportion to the extent of the effusion, and the function of the lungs is correspondingly interfered with.

This effusion may take place rapidly, producing acute œdema, or more slowly, presenting the disease in a chronic form.

Symptoms.—The symptoms of the disease, in an acute form, are panting respiration—rapid and superficial; in severe cases an intense feeling of dyspnœa, and a cyanotic condition of the lips and countenance. In œdema of other tissues, the fluid remains until absorbed away or discharged by punctures. In this, more or less of the serous effusion passes into the bronchial tubes and is expectorated, generally with a moist, stuffy cough. The expectoration is watery and frothy, and sometimes tinged with blood.

The more common and immediate pathological state giving rise to the effusion is hyperæmia; and rapid congestions of the lungs, active or passive, are under various circumstances liable to occur. The attack may be so sudden and severe as to cause death in a very few hours, even in subjects of fair strength; and in weak ones in almost as many minutes.

Causes.—The morbid conditions with which it is most likely to be associated, and of which it may be regarded as a symptom, are obstructive disease of the left side of the heart, especially mitral stenosis, and disease of the kidney, or both of these combined. The contracted or cirrhotic kidney, interfering so much as it does with the eliminative function of the organ, is particularly liable to produce dropsy here, as elsewhere. It may, however, occur in the latter stage of various other diseases, and to a greater or less extent is present in most cases of pneumonia.

Diagnosis.—The symptoms mentioned, and the existence of the diseases liable to produce it, will readily lead to a presumptive diagnosis, which will be confirmed by a physical examination.

On inspection, the range of expansive motion of the chest in respiration will be diminished, and the frequency of the movements will be increased.

There will be dulness on percussion, especially in the more depending parts of the chest; and the dulness will be accompanied with feebleness or suppression of the normal respiratory murmur. Differing from pneumonic consolidation, neither the vocal fremitus nor vocal resonance will be increased. The most characteristic sign, however, and a quite conclusive one when taken in connection with the other evidences in the case, is a fine, moist râle, more or less diffused, and, as the disease is generally bilateral, over both sides of the chest. The râle is a variety of the adventitious sound described as

suberepitant; and a drier crepitation is sometimes heard in connection with the moist râles.

Compared with hydrothorax and capillary bronchitis, the diseases with which it is most likely to be confounded, there will be *dullness* instead of *flatness* on percussion, as in hydrothorax, and moist crepitations instead of silence in the lower part of the chest.

In capillary bronchitis there are moist, fine bronchial râles on both sides of the chest, but there are symptoms of inflammation which are usually absent in œdema, and in the latter there is dullness on percussion, whereas in bronchitis the percussion is normal, or nearly so.

In the subacute and chronic forms of pulmonary œdema the same physical condition of the lungs exists, but the effusion has come on slowly, much of it may have been expectorated, and the dyspnœa is not so great. It may, however, become suddenly extreme at any time, or may gradually increase and contribute to the fatal result which is likely to occur from the disease which produces it.

In hypostatic pulmonary congestion in low fevers, and in other diseases where there is for a long time recumbency in one position, there is more or less œdema, requiring attention in the management of these cases.

Prognosis.—The course and termination of pulmonary œdema will depend much upon the disease with which it is associated, and of which it is a symptom.

When dependent upon serious and irremediable lesions of the heart or kidneys, although relief may be obtained it is apt to be temporary, and the œdema is likely to persist or recur. In acute cases it is dangerous, but here the result will depend upon its severity and the cause which has produced it.

A long-continued, congested, and œdematous condition will lead to nutritive changes, and various conditions, such as splenization, hypostatic pneumonia, and yellowish red, brownish yellow, and *brown induration*, may result.

Treatment.—In acute pulmonary œdema the course of the disease is often so rapid and severe that the most prompt treatment is required.

It is generally admitted that blood-letting is one of the most efficient means of speedy relief in this dangerous affection, and in a patient of previous fair strength and sufficient blood, and where the symptoms are urgent, it should not be omitted. By unloading the venous system the dyspnœa is relieved and the effusion checked. The next most speedy and efficient measure is the diversion of the blood to other parts by ligation of the extremities, and also by the application of numerous dry cups to the chest, by hot and stimulating pediluvia, and by mustard plasters to the surface in different places.

While these means are being used an active emetic may be given to promote the expulsion of the fluid from the alveoli and bronchial tubes, after which, or without the emetic if the effusion is mostly in the interstitial tissue and lymph spaces, a hydragogue cathartic should be given, and elaterium is the most prompt and efficient of its class; and if the heart is failing in its power to carry on the circulation, it must be supported by cardiac stimulants, one of the most efficient of which, in these cases, is digitalis. It is somewhat slow in its operation, however, and in the meantime more diffusible stimulants, as ammonia, camphor, warm coffee, and perhaps alcohol in moderate quantity, may be given.

In cases where the danger is not so imminent, the hydragogue cathartics, as the strength will bear, digitalis as may be required by the condition of the heart, diuretics as the kidneys will allow, and diaphoretics, with counter-irritation, may be trusted.

The jaborandi will usually produce a free loss of fluid by the skin, as well as determine the blood to the surface, and it is a very efficient measure when the condition of the heart will allow of its use.

The treatment of the original disease which has given rise to the symptom will, of course, be required. The importance of changing the position of the patient in low forms of disease, to prevent hypostatic congestion and œdema, has already been sufficiently noticed.

In cases dependent upon obstructive disease of the heart, particularly upon mitral insufficiency with dilatation of the organ, I have repeatedly witnessed the most remarkable effects from a combination of tinct. of digitalis and the syrup or elixir of phosphate of iron, quinine, and strychnine, 3i of the latter with from eight to fifteen, or possibly twenty, drops of the former, three times a day, persisted in for a long period. When the lesion is not too great, though general dropsical accumulations have taken place, the chief symptoms, including those of pulmonary œdema, have nearly disappeared, and a new lease of life and activity has been given.

The inhalation of oxygen, as in other cases of apnœa, may give, temporarily, notable relief.

Other remedies have been suggested and used, such as large doses of acetate of lead; but only those mentioned have received the confirmation of sufficient experience to establish their reputation.

HEMORRHAGE FROM THE RESPIRATORY ORGANS.—HÆMOPTYSIS.

Hæmoptysis literally means spitting of blood; but when the hemor-

rhage is from the bronchi and lung substance, as is usually the case in the disease we are now considering, bronchopulmonary hemorrhage is a more definite expression.

The raising or flowing of blood from the air passages, however, occurs under a variety of circumstances, and the blood may come from different sources.

Exceptionally it may arise from rupture of an aneurism into the air passages; or from a vascular or cancerous tumor protruding into those passages; or from ulcerative processes—syphilitic, tubercular, canceroid, diphtheritic, etc.

Of the more common forms of hæmoptysis there are two kinds, depending upon the source of the bleeding.

The *first*, and by far the most common, is an exudation of blood through the bronchial arteries and mucous membrane, constituting bronchorrhagia; and the *second*, a pouring forth of blood from an open branch or branches of a pulmonary artery, constituting pneumorrhagia. These two kinds of hæmoptysis are widely different in origin, character, significance, and danger.

The first, bronchorrhagia, indicates obstruction of the capillary circulation within the lungs—obstruction of the flow of blood through them from the right to the left side of the heart—or weakness of the bronchial vessels—one or both of these conditions.

The second, pneumorrhagia, indicates destructive lesion of lung substance, or rupture of pulmonary vessels.

In bronchorrhagia the flow is from the systemic vessels—the proper nutrient vessels of the bronchi and lungs, which are comparatively small. In pneumorrhagia the blood comes from the pulmonary vessels belonging to the special pulmonary circulation—from the vessels which carry the whole blood of the system to be aerated, and these are comparatively large.

In bronchorrhagia the quantity of blood lost is usually moderate (though there are exceptions to this), and it generally ceases when the capillary congestion is relieved by the loss of blood.

In pneumorrhagia, in consequence of the large size of the vessels and the activity of the pulmonary circulation, the quantity of blood lost is apt to be large and the flow very rapid—large vessels are opened by destruction of tissue, and the flow may continue until life is extinct.

From the more common form, bronchorrhagia, immediately fatal or even very serious results very seldom follow.

From the more rare form, pneumorrhagia, fatal results often speedily follow, and serious results may always be apprehended.

It is believed that the blood from the bronchial arteries—the

nutritive vessels of the lungs—takes a short course into the pulmonary veins, and does not go back through the rounds of the general circulation and the right side of the heart. Hence obstructed circulation through the lungs—through the pulmonary system—causes congestion of the bronchial vessels, and, in addition to other effects, sometimes produces rupture of them and hemorrhage.

Although this form of hæmoptysis is very seldom immediately dangerous, yet it is sometimes so. The bleeding may not only be free, but in certain diseases of the lungs, and especially when combined with a general hemorrhagic state, as in purpura hemorrhagica, small-pox, etc., frequently repeated attacks may occur, and at length the patient may be exhausted.

Two cases have occurred under my observation, strikingly illustrative of this statement. In one, tuberculosis existed in a young man, a medical student, in its earlier stage of crude deposit. Concurrently he had an attack of purpura hemorrhagica. While laboring under this, he insisted upon going to his home, at a distance. On his way, while passing from one railroad station to another, he was attacked with a profuse bronchorrhagia, and died in a very few hours.

The other case was that of a young clergyman, who was laboring under chronic interstitial pneumonia. He was attacked while on horseback with a profuse hæmoptysis. The attacks of bleeding recurred daily, and sometimes two, three, or four times a day; and at length would only cease when a solution of persulphate of iron was inhaled from an atomizer. After two weeks of such occurrences, death took place by exhaustion from anæmia.

The *post-mortem* examination showed a cirrhotic and carnified condition of the lungs, but no vessels of considerable size were ruptured, the bleeding being evidently capillary and bronchial, or possibly to some extent from the free surface of the alveoli.

Still, such results in bronchorrhagia are so very rare (and nineteen twentieths of the cases of bleeding of the lungs are bronchorrhagic) that, as a rule, when a patient spits blood or throws it up quite freely, he may be assured there is no immediate danger; and that, in fact, the bleeding will do good by relieving the disease—the congestion upon which it depends. This assurance may more confidently be given where unprovoked bleeding unexpectedly occurs, without traumatic violence, without the presence of cavities, as in the latter stages of consumption, and where aneurism, tumors, and ulcerations are excluded.

If bronchorrhagia is clearly diagnosed, no very active measures of treatment need be resorted to. The patient may often be allowed to

cough and clear the bronchi of blood. Only where the hemorrhage is profuse is it necessary to give powerful astringents that may do harm. Patients with such hemorrhages are generally much alarmed, and they should be calmed and assured.

The most frequent cause of bronchorrhagia is tubercle, with its inflammatory results, though it may be caused by chronic pneumonia, pulmonary cirrhosis, etc., or any change in the lung substance which prevents the free circulation of blood through those organs. It may also be caused by obstructive disease of the left side of the heart, or by hypertrophy without obstruction of the right side. Any cause producing weakness of the bronchial capillary vessels may contribute to the result.

Pneumorrhagia may occur from traumatic violence, from extreme congestion arising from hypertrophic or obstructive disease of the heart, and from any disease, gangrene, emboli, pneumonia, etc., which will impair the integrity of the coats of the larger pulmonary vessels. It is, however, more likely to be produced by tuberculous cavities, which destroy the vessels by ulceration and leave them with open mouths. This result is rare, as almost constantly the process by which an abscess is formed blocks up the vessels before destroying them, and thus prevents their bleeding.

But hemorrhage may take place into the tissue of the lung, producing a solution of continuity and a cavity, and, breaking through into the bronchial tubes, may cause an external flow. This is a comparatively rare but a very dangerous condition.

A hemorrhage into the lung substance, with the formation of a blood cavity and a clot, is called *pulmonary apoplexy*.

When blood oozes from small vessels into the tissue of the lungs, but without such solution of continuity as to form a cavity and a clot, it is called pulmonary hemorrhagic infarction. This latter condition is usually produced by embolism, while apoplexy is often caused by violence, or by the rupture of larger vessels from disease of their coats. Extreme congestion, such as occurs in heart disease, may produce either. Hæmoptysis more rarely occurs as the result of infarction than of apoplexy, but it may be associated with either of these conditions.

Though bronchorrhagia is seldom dangerous, and often procures relief not only of the congestion but also of its cause, tending, in some cases at least, to produce absorption of the exudates upon which the obstructed circulation depends, yet, as a rule, it indicates disease of the lungs, tubercular or inflammatory, which is likely to go on, sooner or later, to serious results.

A hemorrhage which is slight and of itself unimportant, is often

the first marked symptom of tuberculosis. It may occur before any physical signs are discoverable, and before other symptoms are developed, and when not excited by special causes, it is indicative of this disease. The patient, therefore, who has had a spontaneous hemorrhage from the lungs, requires careful attention.

It may, however, exceptionally occur from weakness of the vessels where no tubercle is present or follows, as the subsequent history sometimes shows. Such hemorrhage is, however, usually followed by other pulmonary symptoms, and, according to Niemeyer, the injury done by the hemorrhage is often the cause of tuberculosis, though in most instances the tuberculous deposits precede the hemorrhage, and are its cause rather than its consequence; yet, though the hemorrhage is the result of tuberculous deposits, the injury sometimes done by it may increase and hasten on destructive processes and become a cause of phthisical changes. Hemorrhagic infarction, particularly, may doubtless give rise to inflammation, to deposits, and to degenerations resulting in phthisis.

Though hæmoptysis is so commonly a symptom of grave import, and would lead any life insurance company to reject an applicant who had suffered from it, yet not very unfrequently persons having hemorrhage of the lungs, and in some cases repeatedly, have lived a long time after in fair if not in good health.

Diagnosis.—In all cases of hæmoptysis a differential diagnosis between its varieties is important, yet the presumption is that the case is bronchorrhagia. If from the history of the case or from a physical examination there is no evidence of a cavity, of violence, of pulmonary apoplexy or hemorrhagic infarction, we may conclude with much positiveness that the form is bronchorrhagia, and may assure the patient of the absence of present danger.

The diagnosis of hæmoptysis is usually not difficult when the phenomena are witnessed by the physician. The blood is expelled by coughing rather than by vomiting, is of a florid color, is usually frothy, as it is mingled with air in the air passages, and more or less dyspnoea, or a sense of strangling, is experienced. The patient often has sensations in the chest indicating the source of the flow, and the previous history of the case will throw light upon the nature of the disease.

On physical examination of the chest, moist bronchial râles will generally be heard, though when the hemorrhage is moderate they are not always distinguishable. Other morbid conditions of the lungs or the heart will, in a majority of cases, be found acting as a cause of the symptom.

It should be distinguished not only from hæmatemesis, but from

epistaxis and faucial hemorrhage. Blood may flow from the posterior nares into the fauces, and may pass into the larynx and be raised by coughing. Blood from the lungs may be swallowed and afterward vomited, causing hæmoptysis to resemble hæmatemesis. Care is therefore necessary, and in some cases close observers are mistaken as to the source of the blood. Generally for some time after a flow the expectoration will be bloody, and the blood is then usually dark and grumous. Sometimes clots of considerable size will be raised by coughing.

It is well to observe, as sources of obscurity which render the diagnosis less clear, that hæmoptysis sometimes occurs when no other morbid state of the chest is discoverable; that sometimes the blood pours forth so profusely that it is not raised by coughing and is not frothy, and that it may be accompanied with a sense of nausea and efforts at vomiting; and also, that when connected with pulmonary apoplexy, hemorrhagic infarctions, or gangrene, the blood when not profuse may be dark in color when it first flows, as well as when it remains long in the tubes after flowing from the vessels.

The *prognosis* has perhaps been sufficiently indicated in the description which has been given. It may, however, be mentioned that in exceptional but not exceedingly rare cases a bronchorrhagia, though not profuse, is followed by great depression and a rapid development of phthisical symptoms which had scarcely been noticed before. Such instances I have several times observed. In rare cases, and especially in feeble persons, death may suddenly occur from strangulation, produced by the blood closing the air passages. On the other hand, it is important to bear in mind and be able to say to patients for their encouragement, that free hemorrhages sometimes occur without evidence of other serious disease, and from which recovery is speedy and complete. Cases of this kind have come under my observation.

If the import of a pulmonary hemorrhage be such as to forbid presumption, it is not such as to cause utter despair. The physician, so far as he can conscientiously, should encourage hope.

TREATMENT OF HÆMOPTYSIS.

The ordinary cases of bronchorrhagia are more interesting in a diagnostic and prognostic than a therapeutical point of view, and require attention to indications of other pathological states and ultimate consequences, rather than direct efforts to stop the flow. Common salt is a popular remedy everywhere, taken dry in the mouth and swallowed in tea-spoonful doses. In most cases the patient will

have taken this remedy before the physician arrives. It is at least harmless, and it is thought by some of high authority to have much effect.

If the bleeding be free, prompt measures should not be neglected. The physician is by no means justified in regarding and treating a case with indifference. Nothing is more disagreeable to a patient, anxious and alarmed about his case, than the appearance of a want of interest on the part of the physician on whom he relies for aid. One is encouraged by calm but earnest assurances, while he is only disgusted and offended and has his confidence destroyed by apparent indifference. The general conduct and bearing of a physician in the sick-room is a part of his means of benefiting his patients, and should be such as to relieve as much as possible their mental sufferings. A real interest and sympathy will prevent an indifferent manner, and in many cases will do more good than even the skillful use of medicines. In no cases is this more true than in these.

The patient with hæmoptysis should be placed in bed, in a cool room with fresh air, with the head and shoulders elevated, and quietness should be enjoined. If the hemorrhage is decided, he should be forbidden to speak, at least above a whisper, and should be advised to restrain his cough as much as possible without too great an effort. His fears should be allayed by such assurances as may be given, and the fussy excitement of persons about him should be quieted. He should be allowed cold and, if he prefers, acid drinks, or he may swallow bits of ice. If his extremities are cold, warmth may be applied to invite the blood to them, while cold air should be breathed and cold may be applied to the chest by compresses wet in cold water frequently changed. The alternate application of heat and cold has been recommended. A sponge dipped in hot water is applied for a short time, and an ice bag or cold cloths for a much longer period.

It was formerly the practice to take blood from the arm, with the view of diverting the circulation and relieving the internal congestion—the cause of the hemorrhage; and this effect was doubtless often realized. In cases of plethora, when the quantity of blood should be reduced, it is safer to take it from the arm than to have it flow from the lungs, as in the latter case it may produce injurious lesions, and venesection may then with propriety be practiced. In all ordinary cases, however, it is unnecessary, and would generally result in greater loss of blood than would occur from its omission. Besides, there are other quite as efficient measures for relieving the internal blood pressure, while the needed blood is preserved. The ligation of the extremities, in the manner elsewhere described, will readily be seen to fulfill the indication, and in milder cases dry cups and sina-

pisms may aid the ligation or be substituted for it. The ligation should be carefully made by the physician, for if the ligatures are applied so as to arrest arterial circulation, more blood may be driven to the lungs than if ligatures were not used, and, on the other hand, if too much blood is retained in the extremities, severe syncope may be induced. The blood, moreover, should not be retained too long, though the danger of embolism which has been feared cannot be great, since anastomoses between the superficial and deep veins allow of some circulation in the veins which are distended, and prevent absolute stagnation of the blood. Its circulation is restrained rather than arrested, and the restraint may be continued as long as the exigencies of the hemorrhage require. This measure, I am glad to see, receives favorable mention from so high authority as Profs. Flint and Bartholow.

The effect of astringents by the stomach, in hæmoptysis, is probably less than was formerly supposed. Their sympathetic action is, at least, uncertain, and their action by absorption must take some time, and in many cases cannot be very great. When, however, the bleeding is from capillary vessels astringents may have some effect, and when there is no danger of other injury they may be used. Those more commonly advised are acetate of lead, tannin, or gallic acid, and the oil of turpentine. The lead is usually given in connection with opium, and the turpentine with laudanum in emulsion; and it is difficult to say how much of the apparent effect is due to the opiate. This latter agent, by calming excitement and a kind of hemorrhagic erethism often present, is among the most efficient of the general or internal remedies in controlling bleeding. It is generally applicable in hæmoptysis, and will not interfere with other agents.

Ipecacuanha is regarded by some as an important hæmostatic. Bartholow says: "Ipecac. produces an exsanguine condition of the lung, and arrests hemorrhage, also, by the enfeebling effects of nausea on the heart." By its emetic effect it might clear the alveoli and bronchi of clots, but that action would not tend to arrest hemorrhage. It is alleged, as a proof of its hæmostatic properties, that it stops post-partum hemorrhage. That the act of vomiting often has the latter effect is certain; but it is chiefly in consequence of the compression of the uterus by the contraction of the abdominal muscles, by the compression of the abdominal aorta, and by throwing the blood to the upper part of the body. The same principles do not apply in hemorrhage of the lungs; and when bleeding occurs from a cavity with open vessels, the removal of a clot might be disastrous. The general efficacy of ipecac., given to the extent of vomiting in hæmoptysis, must be regarded as doubtful. That it may be useful in some

cases, I am not prepared to deny ; but that it would be injurious in some others, seems to me certain.

Ergot is a remedy which certainly often produces contraction of blood-vessels, and seems therefore indicated in internal hemorrhages ; it has been much used of late in such cases ; and fortunately, it may be added, experience testifies to its usefulness. In severe cases free doses should be promptly given. A drachm or two of the fluid extract may be given every half hour or hour until the bleeding ceases or its constitutional effects are marked. It is probably the most reliable internal hæmostatic we possess. It may be given in large quantities by enema if not borne by the stomach, or, what is still more efficient, ergotine in proper doses may be given hypodermically. This, where the means are at hand, should be the method of its use, as it is thus most prompt in its action.

When there is much cardiac and arterial excitement the cardiac sedatives—*veratrum viride* and *aconite*—will be indicated.

Should the heart's action fail, cardiac stimulants, including *digitalis*, may be demanded. As a *dernier ressort* in severe or protracted cases, or where the hemorrhage repeatedly occurs, the inhalation of astringent remedies by means of the atomizer is available. Among the most efficient articles least likely to produce irritation are the astringent salts of iron. A solution of the persulphate of iron, of quite considerable strength, may be used without apparent irritating effects ; and when the bleeding is from the bronchial capillary vessels this is very efficient in promptly checking it. In extreme cases, in my judgment and as the result of my experience, it should not be neglected.

In severe cases of pneumorrhagia, where the bleeding is from large open vessels, the same general principles of treatment are applicable, but only slight effects can usually be produced. Not unfrequently the case is so rapid that a fatal termination occurs before remedies can be used. Where opportunity presents, similar measures to those already described may be used, according to the conditions in each case. Exertion, loud speaking, unnecessary coughing, and stimulating food or drinks should, however, be most carefully avoided, as well as all the conditions which tend to cause a return of the hemorrhage, until all danger of it is passed. The following may serve as a specimen astringent prescription in these cases :

R	Acid Gallici	3ij
	Acid Sulph. Aromat.....	3j
	Glycerine.....	3j
	Aqua.....q. s. ad	3vj

M.—Tea-spoonful doses.

Dr. Wm. Pepper.

PULMONARY COLLAPSE.—ATELECTASIS PULMONUM.

Under a variety of circumstances the lung tissue, in larger or smaller portions, may be deprived of its tidal and persistent air, and become shrunken and collapsed. This constitutes the condition of atelectasis. When in this condition, the lung resembles in general appearance a piece of flesh, and the term *carnification* has been applied to it.

There are three common varieties of this condition, depending upon the extent of tissue involved and the causes producing it. The first is where a considerable part or the whole of a lung is compressed by a free pleuritic effusion; the second, where limited and scattered portions are collapsed by obstructions of the bronchi supplying such portions, or by pressure from tumors or from other causes directly upon limited portions; and the third occurs in young children from a persistence, more or less extensive, of the fœtal state, or a recurrence of that state after expansion, from debility or some obstruction of the respiratory function.

The first variety is very simple and easily understood. By the pressure of the fluid upon the lung the air is excluded from the alveoli, and, to some extent, from the bronchial tubes; pulmonary circulation is, to a considerable extent, obstructed; a congested condition occurs; exudations and hyperplasias are likely to take place; and the condition of carnification is produced. If this state of things is not continued too long, when the pressure is removed the lung expands, often with a crepitant sound, as the partially agglutinated air-cells are opened; but when very long compressed, the consolidation may become permanent. Hence the great importance of removing the effused and compressing fluid early.

The second variety is found in cases of primary or secondary bronchitis; in the eruptive and other fevers, where some of the smaller bronchi are obstructed completely, and the air is absorbed away; or where the mucus in the tubes acts as a valve, allowing the air to pass out as the pressure is from narrower to broader tubes, but preventing it from coming in, as the pressure there is from broader to narrower passages. Bronchitis then may be a cause of collapse as well as of emphysema, and both these conditions may be present in different parts of the same lung, the one compensating for the other. In these cases there will be unevenness of the lung surface in bulk and color, the collapsed portions being shrunken, congested, and red, while the healthy and distended portions are prominent and paler; and, as in

the other case, if the collapse is not continued too long, the portion of lung will expand when the obstruction is removed, or *post mortem* by blowing strongly into the bronchi.

It is often the case that such scattered collapsed conditions occur in connection with lobular pneumonia, when the collapsed portions, being inflamed, become more fully consolidated, and, *post mortem*, less depressed. When the lungs are collapsed in children, where the chest walls are elastic and readily compressed, the capacity of the chest accommodates itself to the size of its contents and becomes smaller, particularly at the lower part, where the collapse is generally more extensive than above. In adults, with more rigid chest walls and stronger inspiratory force, the size of the chest is not much diminished, and compensation is more likely to occur by emphysema of other portions of the lung or by dilatation of the bronchi.

In infantile atelectasis the condition is readily understood. The respiratory force not being sufficient to expand the lungs, they remain in the foetal or collapsed condition; or the respiration, from any cause, failing a little later, the air admitted may be absorbed and the collapsed condition resumed.

The *symptoms* of collapse in all the varieties will be dyspnoea, intense in proportion to the extent of the collapse, and if great, there will be some degree of dullness or change of note on percussion. On auscultation there will be diminished respiratory murmur over the collapsed portion, and there will also be the proper evidences of whatever other pathological condition may be present.

It will be observed that neither the symptoms nor signs are characteristic or pathognomonic of the affection, and, except in the case of young infants, and often in them, it is an accident of other diseases rather than a distinct disease of itself. It, however, aggravates other affections in which it occurs, and, as has been already stated when treating of chronic bronchitis, it may materially aid in producing bronchial dilatation. In bronchitis, broncho-pneumonia, whooping-cough, measles, etc., especially in children, its occurrence will add to the danger, and may be a material cause in producing a fatal result.

The course and termination of atelectasis will be influenced by the disease with which it is associated. The congenital form is most serious, but when not too extensive and not accompanied with other morbid states, as a patulous condition of the foramen ovale, recovery may take place. Otherwise life is feeble and continues for a short time only, and may terminate in convulsions. When it occurs later in life, in bronchitis or catarrhal pneumonia, there may be imperfect recovery with damaged lungs, some parts becoming emphysematous; while in

others there may be more complete restoration, or caseous pneumonia, and phthisis may follow.

Diagnosis.—Atelectasis most resembles bronchitis, pneumonia and thoracic effusion, and is to be distinguished from them by a careful comparison of the phenomena, rational and physical, and by excluding the evidences of these diseases.

Treatment.—There is scarcely any special medicinal treatment demanded for this condition, aside from that required for the diseases with which it is associated.

In new-born infants, where the respiration is imperfect, pains should be taken to procure full breathing by means described in the works on the management of the new-born child; and in other cases a supporting course is called for, so far as this particular state of the lungs is concerned. Patients should be requested to occasionally take as full and forced inspirations as possible. In cases of children, where intelligent efforts at forced inspiration cannot be induced, and sometimes in cases of adults, other means may be used to induce this effect. Juergensen recommends cold affusions—pouring over the neck, breast, and back a free quantity of very cold water, but best done just after the patient has come from a bath of from 77° to 86° F. It is also stated that a small stream of water directed against the back of the head, over the medulla oblongata, will produce violent respiratory efforts.

The sudden dashing of cold water on to the face and chest is an old and common remedy for inducing respiration in the just delivered child, and for restoring it when suspended from fainting, from anæsthetics, or other causes; and doubtless this may often be made available for inducing more full inspirations, and thus expanding the lungs in cases of collapse.

Respiratory stimulants are indicated, if there are any special medicines fulfilling such an indication.

Belladonna and arsenic are supposed to act in that way, and may be given in suitable doses.

When it depends upon bronchitis, that disease requires to be treated as in other cases with similar symptoms. In the subacute and chronic cases, either the iodide of potassium, turpentine emulsion, or iodide and carbonate of ammonia may be required; and belladonna or atropine, to act as a “respiratory stimulant,” may be added.

The inhalation of compressed air, as heretofore described, would be peculiarly appropriate here, whenever from the condition of the patient it is practicable, as tending to expand the lungs.

In debilitated cases, tonics, supporting diet, etc., will be required.

PNEUMONIA.—PNEUMONITIS.

A general view of this affection will first be presented.

These terms are applied to inflammation of the lung substance, or of the vesicular and connective tissue of the lungs. The lungs, as a whole, are composed of bronchi, air vesicles, blood-vessels, lymphatic glands and vessels, and connective tissue. This last is a fibrous structure forming part of the walls of the bronchi, the air vesicles, and the vessels, holding together the other structures and forming the pulmonary pleura.

The walls of the air vesicles, or alveoli, are composed of a thin layer of connective tissue with some elastic fibres intermingled. These alveoli are lined with cells in early life, differing, however, in character from those which line the internal surface of the bronchial tubes, a particular description of which has been given; but in adults this cell character of the internal lining of these small cavities is much less marked, and in some of them there is only a thin homogeneous layer, containing some scattered nuclei and occasional nucleated cells. In the walls of the vesicles, beneath this delicate lining, on their free surface, is imbedded a layer of capillary blood-vessels. Through the coats of these capillaries, and the tissues which cover them, free osmosis between the blood and the air occurs. This vesicular lung structure is peculiar, and may be diseased when other tissues, however near, are scarcely affected. An inflammation may be confined to these walls and their lining membrane, or to the interstitial connective tissue of the lungs; or both may be affected, but one or the other chiefly, constituting different anatomical forms of pneumonia.

Inflammation involving the proper lung tissue may extend to the bronchi on the one hand, or to the pleura on the other, and occasionally to the bronchial glands and other organs, producing complications; but when this extension is but slight, as is often the case, amounting to little more than hyperæmia, the affection is regarded as simple pneumonia of one form or another.

In inflammation here, as elsewhere, hyperæmia, exudations, and hyperplasias result—hyperæmia everywhere, exudates mostly in the air vesicles, and hyperplasia more in the connective tissue. The exudate in the alveoli may be fibrinous and corpuscular, constituting a coagulable, blood-stained material; or it may be more free from fibrinous and plastic corpuscular matter—more serous, bloody, and diffuent; or it may be chiefly mucus, or chiefly pus; or pus corpuscles and blood corpuscles may be mingled with any of the other ingredients of the exudates.

When the exudate is mostly mucus the bronchial tubes are gen-

crally involved, and the inflammation is likely to occur in scattered lobules, and not in a continuous portion or whole lobe of the lung.

When the inflammation is confined to the interstitial connective tissue, or is extended to it from the bronchial tubes, it is apt to be chronic in character, and lead to a sclerosed or degenerated condition of the lung substance.

In consequence of these differences there are various anatomical varieties of pneumonia differently named, the chief of which are croupous, lobar or diffused ; catarrhal, lobular or patchy ; and interstitial, fibrous or sclerotic.

There are other varieties as well, depending upon the causes and types, and the particular courses and results of the disease.

Dr. F. Delafield makes six varieties of pneumonia, viz. :

1. The pneumonia of heart disease.
2. Lobar pneumonia of adults and children.
3. Lobular pneumonia of adults and children.
4. Interstitial pneumonia.
5. Pneumonia produced by pressure upon the trachea and bronchi.
6. The inflammatory lesions of acute tuberculosis, and of acute and chronic pulmonary phthisis.

Not only these, but other distinctions depending upon the general state of the system, as well as upon causes, types, etc., might be made.

A broad distinction should be made between idiopathic or primary, and symptomatic or secondary cases.

The idiopathic cases are usually much more definite in form and specific in course, while the secondary are more varied by the character and continuance of the diseases upon which they depend. A distinction should, perhaps, be made in lobar or croupous pneumonia between the cases produced by accidental causes, and those dependent upon a specific influence. The accidental causes, which seem capable of themselves of producing a form of the disease, are cold and wet, drafts of air in a heated state of the body, prolonged exposure to a very low temperature, the direct action of mechanical or chemical irritants, such as the inhalation of irritating gases or dust, or more palpable substances, irritating liquids, or simple water.

The specific form may be independent of any of these influences. It is now believed to be produced by a specific cause or influence. similar to those zymotic causes which produce the specific fevers. If this difference really exists (and it seems to me at least probable), it may not always be distinguishable, since, when the specific and essential influence is present, the conjoined effect of exposure may have brought it into action, and a strictly specific form of disease may thus be the apparent result of an accidental cause.

The same is true in the case of cholera and other diseases unequivocally specific, and it may be that true croupous pneumonia has always connected with it a specific cause. A belief in the specific character of croupous or lobar pneumonia is at present quite general, and that it is very often so—generally, indeed, in its typical forms—there can be little doubt. But different forms of inflammation of the lung tissue are secondary to other diseases. The extension of the inflammation in bronchitis, oftener to the air vesicles in the acute forms, and to the connective tissue in the chronic, was dwelt upon when the pathology of that disease was discussed.

The occurrence of pneumonic inflammation in various fevers, typhoidal, eruptive, etc., was noticed when those fevers were described. Its frequency in pyæmia and septicæmia is well known, and has already frequently been referred to. We shall find it a complication in diseases of the kidneys; and in diseases of the heart and blood-vessels often as the result of emboli and thrombi; and from various blood poisons generated in the system or received from without, the lungs are often inflamed. Many of these forms are, perhaps, better discussed in connection with the diseases which give rise to them. Some of them are quite peculiar in their phenomena and course, and their treatment is connected with that of the diseases upon which they depend.

The *pneumonia of heart disease* has peculiarities; and that due to obstruction of small branches of the pulmonary artery, either by embolism or thrombosis, occurs, for the most part, in the course of pyæmia or septicæmia; but both these varieties should, perhaps, receive some notice here.

A form of pneumonia from heart disease, having some distinctive characteristics, is produced by the persistent chronic congestion attendant upon obstructed circulation through the heart, more commonly from stenosis or insufficiency of the mitral valves. Though not always distinguishable in the variety of symptoms that occur in these cases during life, this pneumonic state often contributes largely to the patient's death; and, from the persistence of the cause, it is not likely to be entirely removed. It rather gradually increases, the lung becoming more and more unfit for the performance of its functions.

Post mortem the lungs affected do not collapse as in health, the tissue is compact, heavy, inelastic, and crepitates but little on pressure; the diseased part has often a yellow, brown, or reddish-brown color, the alveoli are more or less filled with exudate, and the whole tissue is swollen, constituting a modified form of hepatization. The cut surface gives exit to a darkish, slightly frothy fluid. Microscopically, more or less normal lung tissue is present with extravasated blood

into the tissues and interstices, and this is in different stages of transformation into pigment. Dilatation of the capillaries, hyperplasia of the walls of the air vesicles, exudation of blood corpuscles, and accumulation of new or embryonic epithelium in these alveoli, are found. The term *brown induration* is applied to a state of the lung which often results from a continuation of this form of disease.

The *Symptoms* produced by this condition are so mixed with those caused by other accompanying states of the heart disease that they are often not distinguishable from them. Cough and expectoration of mucus and blood occur, but these may arise from bronchitis with simple pulmonary congestion; there is dyspnoea, but this occurs in simple obstructive heart disease; there is moderate elevation of temperature, but this occurs in bronchitis.

The *Physical Signs* are dulness on percussion, to a greater or less extent; but this again may be produced by œdema, or it may be masked by hydrothorax, which is often present. The crepitant râle is sometimes but not always heard, and when it is moist it is not distinguishable from that produced by pulmonary œdema, which is common in obstructive heart disease; and the bronchial râles, which are produced by the exudate from the lungs accumulating in these tubes, may belong to an accompanying bronchitis. Bronchial respiration and bronchophony would be more characteristic, but they are sometimes absent, as the lung is not so uniformly and completely solidified by a firm exudate as in lobar or croupous pneumonia.

The *Diagnosis*, then, is not quite clear and demonstrable, but is to be inferred from all the symptoms and signs given, and from a comparison with the phenomena of the affections it resembles. The history of the case, the fact of heart disease, and the absence of some of the characteristics of the other diseases, will lead to at least a proximate or probable conclusion.

The *Treatment* in all these cases should be largely directed to the mitigation of the obstruction of the circulation through the heart. For this purpose digitalis is perhaps the most important remedy, and this should often be combined with other cardiac tonics, as the elixir of phosphate of iron, quinine, and strychnine; while eliminatives—laxatives, diuretics, and diaphoretics—will aid in abating the dropsical condition so commonly present.

If the pneumonic inflammation is more acute, and the diagnosis is made, the remedies applicable in other forms of pneumonia, taking into account the condition of the heart lesion, may be required. The antipyretic and anti-inflammatory doses of quinine and digitalis will generally be peculiarly applicable.

In the pneumonia produced by *embolism* or *pyæmia*, the disease is

in patches, usually of a moderate size, and often limited by the margins of lobules.

These patches are sometimes simply engorged, at other times they are in a state of red or gray hepatization, they are not unfrequently the seat of hemorrhagic infarction, and sometimes of a rapid suppuration or gangrene. Cavities may result if life is continued ; and when near the surface of the lung, the pleura is involved in an inflammatory process, generally limited in extent, but with more or less exudation. In pyæmic and septicæmic cases infectious matter is generally in the emboli, and then destructive and suppurative processes are more certain to occur.

The *Diagnosis* is determined by the usual physical evidences when the inflammation is near the surface and of much extent ; when it is deep seated in the lung, the physical signs may be entirely obscured, and the symptoms may be mingled with, and covered by, those of the primary disease and the pyæmic or septicæmic phenomena. Here, too, the diagnosis will often be conjectural and uncertain.

The treatment will be merged into that for the general condition—quinine, supporting and antiseptic measures.

When hyperpyrexia occurs, the antipyretic measures—salicylate of soda, quinine and the bath, the latter cautiously used in this debilitated state—and supporting measures—cardiac stimulants—should at the same time be tried. In these cases the pack or the tepid bath will perhaps be safer than the general cold bath.

All therapeutic measures in those complicated and severe cases too often fail of success.

Other secondary or symptomatic forms of pneumonia will be found referred to in connection with the primary diseases producing them.

LOBAR, DIFFUSED, FIBROUS, OR CROUPOUS PNEUMONIA.—LUNG FEVER.

This is by far the most frequent and most typical form of idiopathic pneumonia in adults ; is a frequent cause of death, particularly in elderly persons ; is a specific form of severe disease inclined to run a somewhat definite course, yet is much under the control of remedies ; and from its frequency, severity, often definite character, and frequent amenability to treatment, requires to be carefully studied.

This regular form of acute idiopathic pneumonia has three important elements worthy of recognition : an anatomical process, a febrile state, and an evolution or series of developments. Left to itself, it

tends to a special course, or the passage through several stages, but it does not necessarily go through them all, sometimes coming earlier to a spontaneous termination ; and, contrary to the opinion often expressed, it may frequently be brought to a speedy conclusion by early therapeutic measures.

In this form of pneumonia the inflammation is chiefly on the internal or free surface of the alveoli or air vesicles, resulting in an exudation of a coagulable substance resembling the false membrane of croup, and hence it is called *croupous pneumonia*. The exudate contains a considerable quantity of fibrine, which has suggested the name of *fibrous pneumonia*. It involves a continuous portion of a lung, or a whole lobe, and hence is called *diffused* or *lobar pneumonia*. It is accompanied with a somewhat specific form of fever, which some regard as the primary affection of which the inflammation of the lung is the expression, or one of the incidents, as disease of Peyer's glands is an incident of typhoid fever, or as the eruption of small-pox is an incident of that disease, and hence it is sometimes called *lung fever*. It is acute in its access, and commonly so in its course and continuance, and is therefore called *acute*, *croupous*, *fibrous*, *lobar*, or *diffused pneumonia*.

It sometimes prevails as an epidemic, and often has seasons of more frequent occurrence, as if dependent upon a specific or zymotic cause ; and at different periods and in certain localities presents peculiar types. It very often, however, occurs sporadically, presenting its ordinary typical form.

The *Phenomena* of this form of pneumonia are marked, and will be described in the order in which they present themselves to the practitioner who studies them throughout their course ; the living phenomena first, not only in time but in importance, though the post-mortem conditions are essential to their explanation and a full understanding of the disease.

Symptoms.—Sometimes after exposure to cold and wet, or in conditions of debility or ill health, but frequently without exposure and in full health and vigor, the patient has a chill, which sometimes comes on suddenly, and at other times is preceded by general pains and a sense of illness. The chill is generally decided, and often protracted to from one to two or even three hours. The internal temperature is increased at the same time, and soon the heat becomes general, rising speedily to 102°, and going on to 103°, 104°, and sometimes reaching 105° F. by the second or third day. The face is purplish and red—has a dusky hue with a red ground tint, with more redness upon the cheeks than elsewhere. The patient has the appearance, and experiences the feelings, of decided illness. There is more or less dyspnoea,

with a short or shallow respiration ; there is commonly pain in the chest, sometimes sharp and catching when the pleura is involved, but oftener deep and dull, though occasionally the pain is nearly or quite absent. There is cough, but not as frequent or severe as in bronchitis ; and expectoration, but at first not usually abundant ; and there will be a coated tongue, thirst, anorexia, and the other usual symptoms of fever.

These symptoms are apparent to the most superficial observer, and would lead most non-professional persons of experience in sickness to a suspicion, if not a rational conclusion, of the presence of pneumonia.

For a more systematic study of the living phenomena they may be divided into those

1. Produced by inflammation and fever upon the system.
2. Those caused by the local lesion ; and
3. Those discovered by physical exploration.

1. Under the first head we have the general sense and appearance of illness; the protracted chill; the elevation of temperature; generally giddiness; headache, frequently severe; not unfrequently delirium; sometimes a full and laboring pulse, increased in frequency, but not unfrequently quite feeble and rapid; a furred and sometimes dry tongue; thirst; loss of appetite, and scanty, dark-colored, and loaded urine.

Some years ago much was made of the alleged fact that when the disease was fully developed, especially when hepatization had taken place, the chloride of sodium disappeared from the urine and appeared abundantly in the expectoration. A diminution of chloride of sodium in the urine is common to many febrile states, and an increase of this salt in the sputa occurs in other cases than croupous pneumonia and hepatization of the lung. It is, therefore, not distinctive of this form of disease, and, in fact, the salt is found, though in diminished quantity, in the urine of patients whose lungs are hepatized. The significance and importance of this diminution of common salt in the urine is not determined, and is probably not great.

The skin, while dusky, red, and hot, is perhaps in a majority of cases dry, though not unfrequently moist, and sometimes the perspiration is free.

2. From the local lesion there arises dyspnoea, pain, and cough, with expectoration of tough, glairy, bloody, and rusty bluish-yellow or greenish sputa, and later in the disease the expectoration often consists of nearly pure pus. From the obstructed circulation through the lungs, and from contiguous sympathy, especially when the inflammation is in the lower part of the right lung, its most frequent seat,

the liver is congested and a moderate jaundiced appearance is often present.

3. The physical signs vary at different stages of the disease. For the first day or more, they are not marked and characteristic; but when exudation takes place into the air vesicles, and before they are completely filled and the affected lung is consolidated, the peculiar crepitant r  le or crepitation is heard, and there is slight dulness on percussion; and at a later period, when more complete consolidation occurs, the mobility of the part is notably diminished, the dulness on percussion is more marked; and now bronchial respiration and bronchophony are heard, and generally more or less bronchial r  les, the latter from the exudate on its way to be expectorated partly filling the bronchial tubes.

In engorgement, and especially in consolidation or hepatization, the accumulation of blood in the vessels, and the exudate of its richer constituents in the tissues and alveoli take a large quantity of this fluid from the circulation, and at the same time render a large portion of the lung incapable of performing the function of respiration, while the circulation through the lung is obstructed, and the right side of the heart is congested and distended with blood; and these causes, together with the shock of the disease and the destructive influence of the high temperature, not unfrequently produce death by exhaustion or asthenia, or by apn  a, or by both combined.

In the later stages, when suppuration freely takes place, the patient may succumb from exhaustion, or from filling up of the bronchial tubes and the resulting apn  a.

The fever is apt to assume a hectic form when suppuration occurs, and if the disease continues more than three weeks, there is apt to be disorganization of some kind—induration, ulceration, or abscess. The disease may be fatal at a very early period, from the extent of the congestion, but a fatal termination is usually from the sixth to the twentieth day; in case of disorganization, however, it may be much later.

Prognosis.—The severity and prognosis are influenced by the age, sex, habits, and strength of the patient; by the season and locality; by its sporadic or epidemic occurrence; by the character of the epidemic, the fact of the pneumonia being single or double, and by the character of the sputa, whether tenacious, or diffuent resembling prune juice in appearance.

If the disease is simple and single, and occurs in a vigorous person in early adult or middle life, the prognosis is good. But in old age, or if double, or often if complications exist, or if there be a sudden

suppression of expectoration without improvement of the other conditions, the prognosis is bad.

There are varieties as to the particular phenomena in different cases, and to the brief sketch of the disease given there needs to be added a more full and detailed account of some particulars.

Symptomatology.—Though in some cases premonitory symptoms of an attack are quite conspicuous, continuing from one to a few days, sometimes with symptoms like a common cold, in others the access is exceedingly sudden. Sometimes without any warning, and without any unusual or known exposure, the patient is awakened in the night with a profound chill and a severe sense of illness. The attack may occur in the daytime, with equal suddenness and severity. The chill may be short and decisive, or protracted to two or three hours, or in a remitting or intermitting form for a longer period. In old persons the chill may be absent, and the disease insidious or even latent, the other usual characteristic symptoms being absent, early prostration and coma coming on without cough, pain, or much fever. In these cases the physical signs alone are to be relied upon, and if the disease be central in the lungs, even these may be obscure. They are generally, however, distinguishable, and in severe diseases in such persons, whatever the symptoms, the chest should be carefully examined. At the onset in children there are sometimes convulsions, with unconsciousness and vomiting; and with adults there are not unfrequently stupor and delirium. Usually there is a short, somewhat paroxysmal, painful, harsh cough. From its painfulness the patient often makes an effort to suppress it, but it recurs from time to time. It is at first accompanied with very little expectoration, unless a bronchitis has preceded, and what occurs is mere mucus; but soon, sometimes within a few hours, and at other times after a day or two, a tenacious, rusty, or more decidedly bloody expectoration occurs, sometimes moderate in quantity, but at others more abundant, and when scanty it is often raised with some difficulty. It is sufficiently tenacious to adhere to the vessels into which it is injected, and when possessed of all these characteristics, is almost positive evidence of pneumonia.

The difficulty of breathing will be influenced by the extent of the disease and the conditions of the system, but it is usually decided. The respiration is increased in frequency more or less, according to the extent of the disease in the lung, the amount of fever, and the excitability of the system. The ratio of the pulse and respiration is changed. When the local disease is extensive there may be but two pulsations to one respiratory movement, and in extreme cases the ratio may be one and a half to one. Its absolute frequency varies

from the normal up to 50 or 60, and sometimes even more, per minute.

The *feeling* of dyspnœa varies, depending much upon the condition of the nervous system. When it is very great there is usually more danger; but when the respiration is very rapid, without a feeling of dyspnœa, it indicates a blunting of sensibility which is by no means a good omen. The character of the difficult breathing is *panting* in pneumonia, while it is labored in bronchitis and tracheitis and in other diseases which interfere with the passage of air through the air passages.

Although the common characteristic expectoration is tenacious and rusty, it is sometimes diffuent and like "prune juice" in appearance. This indicates a lower or more typhoidal condition, and one of greater danger. Sometimes in the aged, and when there is a complication of rheumatism, and in some other conditions, the sputa may be exceedingly slight or absent.

When the respiration is very rapid, the air does not remain long enough in the lungs to become heated, and the expired air is comparatively cold.

The pulse varies much in frequency—from 60 to 160, and the case is more unfavorable when it is extremely slow or very fast. It may be full, or small and oppressed; and in unfavorable cases, toward the last, is usually rapid and feeble, and often dicrotous.

The blood is fibrinous, and heart clots are not unfrequent in fatal cases. The pain is varied in amount and character by the fact and the extent of the pleuritic complication. In a majority of cases there is more or less catching pain, but when there is no pleuritic inflammation, the pain generally subsides in a few days. In some cases there is only a sense of heat, and no positive pain from the beginning and throughout the disease.

The function of the liver is impaired much more in some cases than in others; the stomach is commonly congested, but the impairment of its functions varies in different cases. The urine abounds in urates and pigment, and bile is often present. Chlorides are deficient, and often in the full development of the disease are absent. Albumen is not unfrequently present, and is probably largely due to a congested state of the kidneys from obstructed circulation through the lungs.

The brain symptoms are often severe from deficient oxygenation of the blood, from the shock of the local disease, and from the heat and other phenomena of the fever. In severe cases delirium is generally present, and not unfrequently there are other evidences of severe nervous disturbance.

The temperature varies in different cases. During the first two or three days it is commonly from 102° F. and upward. It may not be so high, or it may go up to 105° at an early period. In a typical case, terminating in resolution, the record commencing on the fourth day, about the period of the disease when patients usually enter a hospital, the temperature and pulse are as follows:

TEMPERATURE.				PULSE.		
Day.	Mean.	Maximum.	Minimum.	Mean.	Max.	Min.
4.....	103.6°	104.2°	102.6°	108	120	100
5.....	103.9°	104.2°	103.6°	107	116	98
6.....	103.4°	104.2°	103.0°	106	112	100
7.....	100.6°	101.4°	99.4°	93	112	82
8.....	98.6°	98.9°	98.0°	76	84	72
9.....	98.5°	98.8°	98.0°	76	84	70

The respiration in a case of this kind would average from 35 to 38 per minute.

When the temperature at the maximum is 104°, the pulse 120°, and the respiration 40 per minute, there is proximately a decided but a medium case, where the prognosis would be favorable in a vigorous and previously healthy adult. But when the figures are materially above these the case is severe; when much below, if uncomplicated, the case is mild. (Parks.)

According to Juergensen, at the height of the disease the temperature ranges from 104° to 105° F., and in fatal cases it may go up to 109° or more. It is slightly higher when the upper lobes are the seat of the disease than when confined to the lower, and such cases are more apt to be severe and fatal. The temperature is somewhat higher, with a similar extent of the inflammation, before than after puberty, and in women just before menstruation, abating somewhat when the flow commences; and it is often slightly increased just before a material defervescence.

The quality of pneumonic fever is not obstinate—it is often readily abated by treatment. It is sometimes noticeably remitting, and it commonly varies at different hours of the twenty-four; but if left to itself the variations are not generally great—its course is pretty uniform until defervescence occurs. The final abatement of the fever is more likely to commence late in the evening, and the temperature at that hour can the more readily be influenced by antipyretic treatment.

When the inflammation terminates by resolution and by *crisis*, the temperature comes down to the normal in from sixteen to thirty-six hours. If it is more than seventy-two hours in attaining the normal standard, the fever is said to terminate by *lysis*. If much more time than this elapses from the first marked spontaneous abatement before the disappearance of the fever, the disease lingers and resolution has not occurred, or it is complicated with some other morbid state. Sometimes at the crisis the temperature falls below that of health.

The condition of the temperature is, on the whole, the most important indication of the severity and continuance of the disease. When it materially abates, unless in some cases in the very last stage from collapse, the active inflammation has abated, whatever other symptoms may be present, and if the patient be sustained, improvement in all respects may be expected. The pulse, however, has important indications. A very rapid, and especially wavy, irregular, empty, and very compressible pulse, is very unfavorable. Failure of the heart's power to propel the blood through the obstructed lungs is the most frequent immediate cause of death, and this condition of the pulse is indicative of that failure. Coagula or fibrous concretions may form in the heart and vessels in this condition, hastening the fatal result. More decided lesions of the heart are, however, rare. In collapse the extremities, from more complete failure of the circulation there, may be cold, while the trunk may be hot. Profuse sweating in the collapsed condition is unfavorable, but moderate and occasional spontaneous sweating reduces the temperature, and is favorable; and sweating induced by treatment is usually relieving.

The motion of the affected side is often instinctively and also voluntarily restrained, especially when there is a pleuritic complication, by slightly bending the spine toward the diseased side, and the well lung, by the same position, is left more free to move in respiration. When the pleura is involved the pain often extends beyond the inflamed part, and, as in other cases of lung disease, a reflex or sympathetic pain may occur on the side not affected, while absent on the diseased side. This should be borne in mind, as otherwise unnecessary apprehension may be entertained by the physician, and injurious alarm felt by the patient, from the belief that both lungs are involved. The discovery of physical signs, usually with aggravation of all the symptoms, will alone justify the conclusion that the pneumonia has become double.

Pathological Anatomy.—Before proceeding to a more full description of the phenomena discoverable by physical examination, the pathological conditions as revealed by *post-mortem* inspection and other means of investigation must be described, as the physical signs

are dependent upon anatomical changes, and can only be understood by a knowledge of them.

The body of a person dying of acute pneumonia is not much emaciated, as the disease has not continued sufficiently long to produce that effect. The *rigor mortis* is usually decided, and a cyanotic condition, and livid spots on the surface, are generally observed. The right side of the heart is filled with dark blood, generally coagulated, and large and often fibrinous clots have formed, frequently extending into the pulmonary artery. These are sometimes very firm and adherent to the endocardium, like an organized false membrane.

The veins above the heart are distended, from the obstructed circulation through that organ, and the substance of the *brain* is often œdematous from the same cause. The abdominal organs are congested, the spleen enlarged, the liver engorged, and the kidneys often catarrhal. The stomach and intestines are often perceptibly hyperæmic.

But the lungs are, of course, the seat of the greatest changes. The affected portions of the lungs do not collapse, as in the healthy state, on opening the chest. Not only the part fully inflamed retains to a great extent, and often completely, its bulk, but more or less of an œdematous condition extends beyond the inflamed part, and there are often points of congestion scattered outside the inflammatory limits, preventing complete collapse of the portions thus affected. A frothy fluid, mixed with mucopus and stained with blood, oozes from the cut surface of these portions of the lungs in many places.

Disturbance in the function and circulation of a considerable portion of one lung, especially when suddenly occurring, is very apt to produce more or less disturbance in the opposite lung, and hyperæmia and œdema of the latter are not unfrequently found.

The lesion at the seat of the inflammation is divided into three stages, depending chiefly upon the length of time the disease has continued in the part, and all these are preceded by a state of simple hyperæmia. These stages are :

1. Inflammatory engorgement.
2. Hepatization—divided into two substages, red and gray ; and
3. Purulent infiltration.

These stages shade off into each other, and the divisions into stages are to some extent arbitrary or conventional. Some make the second stage that of red hepatization exclusively, and the third that of gray hepatization, embracing also the stage of purulent infiltration, for the reason that the gray hepatization differs from the red by the beginning of purulent infiltration. This, however, is not the sole.

cause of the change of color, as diminished vascularity, from the pressure of the increased quantity of yellow croupous exudate, is the earliest cause of the change.

The *first stage* is more than simple hyperæmia, or stasis of blood filling the vessels. The blood is changed in its quality and relations, and exudations begin to occur. The lung tissue itself is also modified, its cells assuming the embryonic state, with the occurrence of the changes described in the general pathology of inflammation. In this state of inflammatory engorgement, the lung, in its grosser appearance, resembles a condition of stasis and œdema. It is of a dark red color, is heavy, and apparently tough, but more easily torn than a healthy lung. It is dense, and pits are left after pressure, and it is more or less filled with a sero-sanguineous fluid, with thicker effusions into the air-cells, and to some extent into the intercellular tissue. According to the degree of engorgement and effusion, it may crepitate on pressure and float in water, or remain silent and sink. On section, a reddish fluid escapes, watery and bloody, from the air-cells and capillaries and other small vessels.

Microscopically, the blood-vessels of the alveoli are found distended and projecting into their cavity, diminishing their calibre. This, with the effusion which has taken place within them, diminishes their capacity for receiving air, and produces the density noticed.

In the "brown induration" of pneumonia from heart disease, the result of a slower process, the stagnated and effused blood and cells have become pigmented; but in ordinary acute pneumonia that is not the case.

If the disease be not arrested by early resolution, which, if it occur, must generally be induced, the *second stage* follows. In this the exudation into the alveoli becomes more abundant, more corpuscular, *fibrinous*, solid, and tough. A reddish brown, thicker fluid exudes from the cut surface early in this stage; but later, as the exudate which now fills the air vesicles becomes more solid, but little escapes from the cut surface spontaneously, though a dark granular matter may be scraped off. More or less œdema is now present, extending beyond the inflamed part. The inflamed lung is now of a reddish-brown or variegated color, solid but friable, does not crepitate on pressure, sinks in water, is granular and solid, strongly resembling the hepatic structure, and hence the name hepatization.

This red hepatization passes into the *gray* as the exudate in part becomes lighter and in part darker; the diseased lung is less red as the blood is now pressed from the vessels by the greater amount of the exudate, and a yellowish tinge is given by the presence of more or less pus corpuscles. As the change goes on, and more pus corpuscles

appear, the color becomes more yellow, the lung tissue is weakened and becomes more friable, and a greenish-yellow matter exudes when it is cut or torn.

In neither stage of hepatization does the inflamed lung collapse when the chest is opened, and on an average the diseased lung weighs about two pounds more than in health. This increase of weight is due to the increased quantity of blood it contains, and to the exudates poured out from the blood into it, and in a much less degree to proliferating processes which have occurred in the inflamed tissue.

This gray hepatization, when the disease goes through all its stages, passes into the *third stage*, or that of *purulent infiltration*—the exudate in the air-cells now being chiefly pus. The lung is heavy and pits on pressure, it is still more easily torn, its cut surface is of a straw yellow color, with some grayish pigmentary spots, and it exudes more freely a viscid, purulent fluid. When the pus, which is less solid and tenacious than the fibrine, is washed away, the spongy cellular structure of the lung appears.

In whatever stage, if the disease extends to the surface of the lung, the pleura will be changed—will be injected, ecchymosed, opaque, thickened, denuded of epithelium and covered with plastic exudate, and is often the source of a serous effusion.

In some cases the pleural inflammation is diffused, extending to the pleura costalis, and rarely to the peritoneum or pericardium.

The bronchial glands are often congested and swollen; and the terminal branches of the bronchi are more or less congested, contain viscid or purulent matter, and may be plugged up by the exudation from the alveoli passing into them.

Histologically, the engorged blood-vessels and projecting capillaries of the first stage continue in the second; and the thin albuminoid and bloody exudate becomes more corpuscular, fibrinous, and solid. The alveoli become filled with a fine net-work of fibrine, in which is embedded an abundance of leucocytes, red blood discs, and cells without nuclei, the epithelium such as exists in the air vesicles being generally to a considerable extent intact. The capillary vessels, distended and projecting into the alveoli, are filled with blood corpuscles packed and flattened together; and the interstitial septa are slightly swollen. The granular, liver-like appearance depends upon the moulds of the exudates in the air vesicles and the small bronchi.

The pus corpuscles which appear in the latter part of this stage are derived in part from leucocytes, and in part from the epithelial cells of the alveoli, or possibly from small particles of bioplasm passing through the capillaries from the blood; and the fibrine, of course, exudes in a liquid form from the blood, soon coagulating or arranging

itself in the fibrillated form. Some infiltration and proliferation of cells take place in the connective tissue at the same time.

When the purulent infiltration of the full-formed *third stage* occurs, the more solid exudate loses its character ; it becomes softened by fatty degeneration, is less tenacious, and is more easily expectorated. In case of recovery—in the change from this state to health—the epithelium of the alveoli, so far as destroyed in producing pus, is restored, and the circulation returns, but some time is required to restore the lung to its former elasticity and full use. Oedema for some weeks may follow, and degeneration and breaking down may occur. Abscesses, however, seldom result from lobar pneumonia, since the pus forming upon the free surface of the air-cells finds vent and is discharged through the bronchi, and does not break down the tissue by collecting in cavities.

When, however, the inflammation is of a character to produce ulceration, or is more in the connective tissue, abscesses may form, and smaller ones coalescing may produce those of larger size.

When the inflammation is so severe as to arrest the circulation entirely in a part, gangrene will follow ; and according to its extent and other conditions, the dead matter may be discharged and cavities produced, which in time may heal, and recovery take place ; or death may occur from shock, exhaustion, or blood poisoning.

When pneumonia recedes from the stage of hepatization, without reaching the condition of purulent infiltration, the exudate may be but slowly removed, more or less consolidation remaining for some weeks. The process is by disintegration and liquefaction of the solidified exudate, the matter being partly absorbed and partly expectorated. Sometimes, especially where much exudation takes place into the connective tissue, it becomes organized ; and induration lasting a long time or undergoing subsequent degeneration changes may result. Such results, however, are rare where the previous health and constitution were good, and where the hygienic conditions are favorable.

Restoration from the first stage, or that of simple inflammatory engorgement, is usually rapid and complete. The earlier the resolution and the fewer the anatomical changes, the more speedy and complete is the restoration likely to be.

We have in these cases of pneumonic inflammation the essential elements which occur in other forms of inflammatory action. There are—1. Modifications of the vessels and changes in the state and relations of the blood ; 2. The production of an exudate by transmission through the coats of the vessels of liquid fibrinous matter and other forms of bioplasm from the blood ; 3. The migration of leucocytes,

often becoming pus corpuseles, and accidentally, mostly by rupture of capillary vessels, the red globules; and 4. Changes in the pre-existing anatomical elements on the free surface of the alveoli, and in the fibres of the connective tissue.

As we have seen, pneumonia may terminate in *resolution* before exudation has advanced; in hepatization and a slower resolution, in which case the exudate undergoes a fatty change and is thus disposed of; in diffused *suppuration*; more rarely in abscess or gangrene, or in cheesy or fibroid degeneration.

It generally requires from two to three weeks or more for a lung to go through all the stages of a pneumonic process. Spontaneous resolution from the first stage may result in the removal of nearly all the symptoms in a week or ten days, and *the resolution may often be induced much sooner*. Cessation of active inflammatory disease from the second stage may occur in from eight to sixteen days. If abscesses or degenerations follow, the disease may be protracted indefinitely.

A more rapid course than here indicated may sometimes occur, especially in the aged, often with less conspicuous pneumonic symptoms.

Different stages of the disease may be present in the same lung at the same time, the disease being progressive in its localization. Commencing and advancing in its course in one part, it may spread to successive points in its earlier stages. Thus there may be diffused suppuration at one point, gray hepatization at the next, red further on, with inflammatory engorgement, and simple congestion and œdema in succession.

The right lung is rather oftener attacked than the left, and the lower part more frequently than the upper. Both lungs suffer, or double pneumonia occurs, in about eight per cent. of the cases. According to Juergensen's statistics the right lung was affected in 53.7 per cent., the left in 38.23 per cent., and both lungs in 8.07 per cent.

PHYSICAL SIGNS OF LOBAR PNEUMONIA.

It is important to study the physical signs, and they depend upon the changes which have been described. The chief conditions which produce the signs are as follows:

1. The lung is more or less congested and filled by exudates which replace the air in the alveoli and in many of the small bronchi.
2. The congested and infiltrated tissue loses its elasticity.
3. The calibre of some of the bronchi is lessened by pressure of the swollen lung beyond the limits of the pneumonia in its congested and

oedematous state, and at the margin of a hepatized part the inflamed lung may be somewhat compressed.

4. While the exudation is taking place, and before the vesicles are fully filled, air passes into them on expansion of the chest in inspiration, separating their walls, which, when the chest is contracted in expiration, fall together again and are agglutinated by the collecting exudate.

5. A similar exudate in the small bronchial tubes fills them up, and, when the chest expands, air is forced through the obstruction to fill the air vesicles.

6. More or less tenacious sputum accumulates in the larger bronchi, altering their calibre at different points, or more fluid matter may be present through which the air passes in breathing.

From these conditions we may infer the signs which should be present, and which, generally, are discoverable as the disease is developed.

Few physical signs that are unequivocal are present in the first twenty-four hours, and if the disease commences centrally in the lung they may be absent longer, and if it remains central and limited, they may not appear at all. When a larger part of the lung is involved, including a portion of its surface, as in this form of pneumonia is almost always the case, and when the disease is developed, the physical signs are clear and conclusive.

On *inspection* in decided pneumonia the cheeks and lips have a bluish-red tint, while the angles of the mouth and the forehead are of a yellowish-white color, the parts thus contrasting.

The *alæ nasi* move slightly in respiration. In the earlier stage, or that of arterial injection, before the full inflammatory process is established, but after the chill has occurred and the temperature has risen, *inspection* of the chest is nearly or quite negative—at least the two sides move nearly or quite alike, and are of the same size. The respiration, however, will be more rapid, and the comparative length of inspiration will be less; and if there be pleuritic pain, the respiratory movements may be catching and irregular.

On *palpation* the vocal fremitus may be slightly increased over the affected part.

On *percussion* there may or may not be slight dulness perceptible in the same situation. If the congestion be great and at the surface of the lung, some dulness will be discovered by a careful comparison of the sides; but if otherwise, nothing conclusive at this stage is revealed by this method of examination.

On *auscultation* the breath sounds reach the ear weaker, but harsher and rougher, provided the diseased part comes to the surface.

If central only, though percussion may be unchanged, the breath sounds will be likely to be exaggerated if the surface of the lung is quite free from all disease. As the air does not pass so freely into the congested part beneath on the expansion of the chest in inspiration, it will rush with somewhat more force into the unaffected lung at the surface, and some exaggeration of the respiratory murmur in that part will be the result. If the respiratory sound of a part not actually inflamed be weaker than in health, it is more or less engorged, and if in the earlier stage of the disease especially, the inflammation will probably reach it.

In the *first stage* of developed inflammation—the stage of inflammatory engorgement, with commencing and progressing exudations—*inspection* shows no statical change, and but slight diminution of motion in the affected part. Air passes into the diseased lung, but not freely as into the well portion.

As the exudate now partly fills the cells, they will be opened on inspiration, many of them with a slight snapping noise, and the air, bursting through the partially obstructed minute bronchi, may also produce a slight sound, and by one or both of these means the *crepitant râle*—or, as called by some, crepitation—is produced. This is the characteristic sound of the stage of inflammatory engorgement in pneumonia, and when heard in connection with other phenomena is very distinct and conclusive, and gives evidence not only of the existence, but, by tracing its limits, of the extent of the local disease.

Sometimes, however, the exudation is so rapid, the air-cells are so soon completely filled, that opportunity is not given to hear this râle; but then hepatization has occurred with its peculiar evidences.

In this first stage, when the crepitant râle is heard, the lung, being partly consolidated by engorgement and progressing exudation, becomes less elastic and resonant, the *percussion* note will be somewhat less intense, it will be slightly higher in pitch, shorter in duration, and harder in quality. There will thus be some *dulness* no *percussion*, but the auscultation sign of the crepitant râle is most characteristic of this stage.

When the alveoli are filled, and the *second stage* or that of hepatization is produced, *inspection* shows slight enlargement sometimes, though generally this is not appreciable; but there is decided diminution of motion in the affected part.

Percussion now is markedly dull; and vocal fremitus is usually increased, especially if the tubes remain open, and the diseased surface is large.

Mensuration will show with more precision the slight enlargement that may be present.

Auscultation now gives *bronchial respiration* and *bronchophony*, as the solidified lung freely conducts the sounds from the bronchial tubes. These sounds are typical in a thoroughly hepatized lung. The respiration is distinctly blowing, and as if near the ear, and the voice sounds sharp, high pitched, concentrated, and markedly loud.

When the disease is spreading, or has extended beyond its first seat, crepitation will be heard in some parts, while bronchial respiration is heard in others.

A dry, sharp, high-pitched, crepitant r le is heard, or "fine crepitation," as it is called by Dr. R. E. Thompson, of Brompton Hospital for Consumptives, in distinction from "crepitant r le," which he describes as intermediate between "fine crepitation," which is of a dry, stitichy character, and the subcrepitant r le, which has a bubbling quality. This dry, fine crepitation is characteristic of croupous pneumonia, but its sound is approached in capillary bronchitis with scanty secretion, in some cases of suddenly occurring  dema, sometimes in hypostatic congestion, and in pulmonary congestion from heart disease, and temporarily in the unfolding of a collapsed lung, and sometimes in the initial stage of phthisis. The region of the chest in which crepitation is heard is significant. In croupous pneumonia the inflammation affects a lobe, or a continuous portion of a lung, and more frequently a lower lobe. In bronehopneumonia scattered portions are involved with intermediate points which escape; and in initial phthisis the disease, in most cases, is in the upper part of the lungs.

In complete hepatization bronchial respiration replaces crepitation, and the dulness on percussion is decided; but the sound is not flat, as the bronchial tubes are still open, giving some, though it may be a slight, degree of resonance. The percussion resonance is varied, when the condensation is great, by opening and closing the mouth. The bronchial tubes are almost never so completely closed in pneumonia as to prevent the air from passing in and out in respiration, or the sounds from being conveyed through them from the larynx, and silence over the part is exceedingly rare. It is, however, possible in peculiar cases, and a very few such have come under my observation. The denser the hepatization, while the tubes are open, the more metallic and tubular—the more like blowing into the ear—are the bronchial sounds.

Puerile, or compensatory, respiration will be heard in the portion of the lung which is unaffected.

The voice sounds in the dense hepatization are sniffling, metallic, and intense, and in the aged are often tremulous. There may be egophonous pectoriloquy over the larger bronchial tubes, when the condensation of the lung above them is great; and the cough, as well

as the voice sounds, as heard from the chest, is intense. Not only are the cough sounds more intense, as heard over the condensed lung, but the full breath, taken immediately after coughing, will sometimes bring out sounds—crepitations—not heard otherwise. It is, therefore, important to listen to the chest when the patient is in the act of coughing, and immediately after, in this and in many other cases of disease. The “cough-breath” should be studied, and, in most cases, the patient should be asked to cough once or more during an examination.

The heart sounds are better conducted through a solidified than a healthy lung, and are more than normally distinct over the hepatized part.

Bronchial râles, generally dry, may often be heard from the accumulation of sputa in the tubes.

In gray hepatization the expectoration is often more free and liquid, and moist bronchial râles are more likely to be heard. In other respects the physical signs are the same as in the red.

At the height of a severe pneumonia, a degree of retraction and incipient hypostasis, or hyperæmia and œdema, in the well lung sometimes occur. This may give rise to some signs—to slight dulness on percussion, a moderate blowing respiration, and some râles—suggesting inflammation where it does not really exist. In these cases full inspiration may give normal vesicular sounds, replacing the râles. This would not be the case if decided inflammatory changes had occurred.

In the *third*—the fully developed suppurative stage—expectoration, if the strength holds out, is free and purulent, with more or less moist bubbling, bronchial râles, mingled with blowing bronchial respiration, sometimes strongly suggesting a cavity. But the sound is less concentrated than in case of a cavity, and not as hollow. There will be no evidence of disorganized tissue in the sputa.

When there is gangrene which is discoverable, there is great fœtor of the breath, and also of the sputa, which will be of a blackish color. There will be physical signs at first of consolidation; and later, if the patient survives and the tissue is broken up and expectorated, there will be signs of a cavity. These sounds of destruction will vary with the size of the cavities, the smoothness or roughness of their walls, and the character of their contents.

The signs of restoration and of clearing up are of importance. If resolution is from the early stage of inflammatory engorgement, no specific signs of structural change appear, and perfectly normal sounds will soon be restored, even if they are temporarily modified. If resolution occurs after crepitant râles are heard, but before consolidation takes place, the morbid physical signs soon disappear.

When the disease rapidly recedes, and the fever disappears after hepatization occurs, the tubular breathing falls in pitch, is less sharp and metallie, passing to weak and harsh respiration. Bronchophony diminishes, and then as the solid fibrinous and corpuscular exudate partially liquefies and diminishes, a moist *redux* crepitation, and fine bubbling râles in the small bronchi appear.

The percussion note becomes more normal ; but the change may be slow—the exudate not being rapidly carried away—and œdema may continue after all the solid exudate is removed.

The characteristic sputa so generally present, composed of mucus, blood corpuscles, leucocytes, and modified cells from the surface of the alveoli, with abundance of fibrine, often presenting the form of casts from vesicles and smaller bronchi, are sometimes absent.

The physical signs of pleurisy in connection with pneumonia are obscure, as the movement of the lung is often not sufficient to develop friction sounds, and unless the effusion is large, the percussion note may not be distinguishable from that of lung consolidation. When the effusion is free, it may be detected by its proper signs.

Etiology.—The cause of this form of pneumonia has given rise to considerable discussion. Cohnheim regards it not only as a specific disease, but a contagious one, though the evidence of this is not generally admitted to be at all conclusive. The opinion that it has a specific character, and often at least depends upon a peculiar influence, has been already expressed. It cannot, however, be questioned that exposure to cold and moisture, sudden changes of weather, and the other causes named have often an effect in the production of the disease. Its prevalence is extensive over the globe, and it is found nearly alike in all latitudes. Its geographical distribution is different from catarrh and bronchitis. It is not so dependent as these latter upon ordinary atmospheric conditions—upon cold and moisture, sudden changes, etc.—and yet two thirds of the cases of pneumonia occur in the winter and spring months, when atmospheric changes are most common, and but one third in summer and autumn. Rapid changes have more effect in its production than cold or warmth. Indoor occupations in confined rooms render men more liable to the disease ; and yet women, who are more indoors than men, have the disease less. No age is exempt, though it has somewhat different features as it occurs in children, in adults, and in the aged.

Juergensen contends for its specific character, and its comparative independence of exposure and chilling. These causes have less effect than was formerly supposed, and it seems probable, as already suggested, that some cases are entirely independent of any exposure, while others are dependent upon such exposure as one of the factors,

if not wholly and absolutely. In its epidemic forms the existence of a specific cause can scarcely be doubted.

Various other forms of pneumonia may be produced in animals experimentally, but it is said that lobar fibrous pneumonia cannot be. This, if true, must be regarded as an evidence of its specific character.

Diagnosis.—Ascertaining the presence of pneumonia, when the ordinary symptoms and signs are present, cannot be difficult. It is, however, sometimes more obscure, and the disease should be distinguished from several conditions which have features resembling it. In cases of phthisis with attacks of acute inflammation, to which consumptives are liable, the inflammation may cover the evidences of the more permanent disease, and lead to a false prognosis. The distinction is made by obtaining the history of the case and by the location of the inflammation, in the phthisical cases it being generally in the upper part of the lung, and in simple pneumonia oftener in the lower. The inflammation which occurs in phthisis is accompanied by other symptoms of the primary disease, which will receive attention when the subject of consumption is taken up.

Condensation of the lungs presenting its physical evidences may exist as the result of various other processes than those of lobar pneumonia, and sometimes a very careful examination is necessary to make the differential diagnosis. This condensation may arise from—1. Atelectasis in infancy; 2. From large accumulation of mucus in the tubes in the bronchitis of children, and from the gravitation of epithelium into the alveoli in rare cases of bronchitis in adults; 3. From bronchial obstruction and consequent collapse and induration; 4. From hypostasis in low fevers and other severe diseases, from congestion and serous effusion; 5. From inflammatory lymph deposits in the areolar or connective tissue outside of the air-cells; 6. From pleuritic effusion, and condensation from pressure of the lung; 7. From pleural exudates and abscess; 8. From hemorrhagic infarction; 9. From tubercle; 10. From cancer; and, 11. From enlarged bronchial and lymphatic glands.

A study of the history and the symptoms, as well as the signs, and applying the principle of exclusion, will suffice to distinguish the conditions.

Complications.—Pneumonia may occur in connection with other diseases, and various complications may obscure a case. Some of the more frequent complications are: Pleurisy with decided exudates and effusions constituting pleuropneumonia; catarrh of the smaller bronchi; emphysema; chronic cardiac disease with œdema of the lungs; acute valvular, pericardial, or endocardial inflammation; and hepatic inflammation and jaundice. Pneumonia sometimes occurs in the course

of severe kidney disease, and it is then very dangerous—one half of such cases are fatal. It may occur in connection with rheumatism and intermittent fever, but these have but little effect upon its mortality. Intemperance greatly increases its severity and danger. Delirium tremens is apt to occur, obscuring the symptoms of the pneumonia, but the physical signs are present, and must be made available in the diagnosis. The breathing will be more rapid, and there may be bloody expectoration, but no pain may be felt, and the delirium is usually active and great. Pyæmia or septicæmia may complicate a case. Inflammation and swelling of the parotid gland in rare cases occur, and, like the last two named conditions, is always a serious complication. What is commonly called *typhoid pneumonia* is a variety of the disease rather than a complication, though pneumonia may come on during the progress of a typhoid fever, which would constitute a complication. What constitutes a proper typhoid pneumonia is not well defined. When, however, the pneumonic fever is of a specially low asthenic or adynamic and nervous or typhoidal type, especially if there be a diffuent, prune-juice expectoration, the disease will properly take this name. The fact of a case being severe and terminating unfavorably is not sufficient to give it this title.

Prognosis.—The mortality in hospital practice varies from 10 to 25 per cent. From a large number of reports collected from various sources by Dr. V. Hanot, of Paris, in his work on the treatment of acute pneumonia, there appears an average mortality of about 14 per cent. It seems to vary much under different modes of treatment. Thus the average mortality, under indiscriminate bleeding in hospital practice, is shown by these statistics to be 24 per cent. By the free use of antimony the statistics collected by the same author show a mortality of 10 per cent.; in treatment by a variety of remedies, but without bleeding, 7.5 per cent. By what is termed eclectic treatment—selecting from different methods—the mortality was 15 per cent., while from the expectant plan it was 13 per cent.

When we consider the class of patients that go into the large city hospitals in Europe, often exhausted by privation and debilitated by very unfavorable hygienic conditions, with treatment usually delayed until the fifth day, when a large quantity of blood is withdrawn from the general circulation and collected in the inflamed lung, we might expect free bleedings in many cases to be followed by exhaustion and death. But under the bleeding treatment the mortality differed greatly at different times, and in the hands of different practitioners. Thus Louis, in 1828, in the Charité Hospital of Paris, lost 33.3 per cent., while at the Hospital Pitié he lost only 14 per cent. Broussais, in 1838, lost 62 per cent., and Andral, the time not mentioned, lost 56 per cent.

Bouillaud, on the other hand, from 1831 to 1836, in the Charité Hospital, practicing bleedings one after another (*saignées coup sur coup*), lost only 11 per cent.; while Rambeau, of Lyons, who practiced bleeding in the military hospital, having vigorous soldiers for patients, and commencing treatment at the beginning of the disease, lost none.

The statistics from the report of Brera, an Italian hospital physician, are interesting and instructive. Of the patients bled from two to three times, 19 per cent. died. Of those bled from three to nine times, 22 per cent. succumbed; while of those who were bled more than nine, 68 per cent. died. But it will be observed that of these last, which undoubtedly were very severe and obstinate cases, 32 per cent. survived more than nine bleedings. Bleeding, even to this extent, cannot therefore be considered as absolutely fatal, and it is very difficult to say how much it had to do in producing the mortality which occurred. Brera doubtless thought it tended to save the lives of the patients, or he would not have practiced it.

In the Edinburgh Royal Infirmary, from 1812 to 1848, under the bleeding and other antiphlogistic treatment, in the hands of Thornburn, Thompson, Orr, Reid, Peacock, Bennett, and Macdougall, the mortality averaged 35 per cent. Afterward, from 1857 to 1864, in 720 cases in all, under good alimentation, combined with tonic treatment, without bleeding, the mortality averaged 6.8 per cent.

In the Charité Hospital in Paris, under the treatment by bleeding and tartarized antimony, as practiced by Laennec, the mortality was only 3.5 per cent.; while Lebert, at Zurich, following Laennec's method, lost none.

Under the expectant treatment the highest mortality reported was 23.4 per cent., while in some reports, where the number of cases was only from 5 to 10, there were no deaths.

The inferences to be drawn from these statistics, though possessed of a certain degree of value, are yet, as to many particulars, inconclusive and unsatisfactory. They show that the disease must vary greatly at different times and in different places, for similar treatment is followed in different cases by very different results.

In private practice the mortality varies much at different times and among different classes of persons, and much depends upon the character of the epidemic or specific influence producing it.

Acute, single, simple, lobar pneumonia, in an adult between fifteen and forty, will very generally result in recovery spontaneously. If secondary to other diseases, or intercurrent with them, the prognosis is more unfavorable, and in some cases exceedingly so. It is more unfavorable when situated in the upper lobes, as it is then apt to be a

cause or a consequence of tubercle. In double pneumonia about one half die. It is more fatal in females than in males, and especially when it occurs during pregnancy, as abortion and severe hemorrhage are in such cases common. When it occurs in persons of sixty years of age and upwards, one half or more die. Heart clots sometimes form, especially when there are pericardial or endocardial complications, marked by sudden aggravation of symptoms, by a haggard face, irregular and feeble pulse, sinking and death. When the disease goes on to suppuration, and free purulent expectoration occurs, there is danger of exhaustion and of possible strangulation, and the case is serious. When gangrene takes place the result is generally fatal. If an abscess forms in the lung the case is serious; but it is difficult to distinguish it from a pleural abscess, which is much more common and less dangerous.

From the foregoing account pneumonia will be seen to be an important disease, and its wide diffusion and frequent occurrence cause it to figure largely in the bills of mortality.

PULMONARY CONGESTION.

Before proceeding to consider the treatment of pneumonia, congestion of the lungs, so intimately connected with it, requires a brief description.

Pulmonary, like other congestions, may be active or passive. It is *active* when there is undue attraction or propulsion of blood to the lungs, or a sanguineous fluxion from whatever cause; and it is *passive* where there is obstruction to the return of blood from these parts, causing its retention there. In active congestion the blood flows through the lung with more force, and generally with greater rapidity; while in passive, it flows with less than the normal force and much more slowly. Indeed, much of the blood may cease to move and become stagnated in the vessels.

The consequences of congestion of the lungs are various. Deficient oxidation of the blood, and dyspnoea, cough, and a glairy, watery, frothy, and sometimes bloody expectoration, and oedema or hemorrhage not unfrequently are produced. The most common result, however, is the establishment of the inflammatory process in some of the tissues of the lungs. Its effects upon the bronchi have been pointed out, and more or less analogous effects are produced on other tissues. It so constantly precedes the full inflammatory process, and is so often merged into it, that its pathology and treatment become a part of the pathology and treatment of inflammation. Congestion, however, sometimes stops short of inflammation, and

while it is usually a milder process it may occur so suddenly and extensively as to interfere with functions and produce alarming and speedily fatal results. It may be produced by any of the causes which result in inflammation, but is frequently caused by diseases of the heart. Hypertrophy of the right side of the heart produces active congestion, while obstructive disease of the left side causes passive.

Increased respiration, as in violent exercise, produces active congestion, while diminished respiration lessens the flow of blood through the lungs, and causes passive. Exposure to great cold, and afterward to a heated atmosphere, especially in fatigued and debilitated conditions, may cause very severe and speedily fatal congestion. The French soldiers on their winter return from Moscow, after the burning of that city, are said to have died in large numbers from this cause in the warm rooms in which they slept at night after a day's march in the intense cold.

Excessive narcotism, by diminishing respiration, causes pulmonary congestion, and various impressions upon the nervous system may produce a similar effect.

The *treatment* adapted to the relief of the congestion will be modified by the cause and the particular condition of the patient and the character of the congestion. In general it will consist of revulsives, such as cupping, ligation of extremities, and counter-irritation, sinapisms, fomentations, the warm bath, etc.; sometimes bleeding, to unload the vessels; and sometimes stimulants, where much depression exists; and in protracted cases eliminatives will be required. The causal indication should be fulfilled. If it arises from hypertrophy of the right side of the heart, throwing the blood with too much violence to the lungs, *veratrum viride*, *aconite*, and other arterial sedatives will be indicated; if from obstruction of the left side of the heart, or failure of its power to carry on the general circulation, *digitalis*, tonics, and stimulants are required; at the same time eliminatives—*cathartics*, *diuretics*, and *diaphoretics*—will be useful, especially where there are oedematous effusions; and revulsives, as in other cases, may aid in procuring relief.

When it arises from changes of innervation, nervines, antispasmodics, stimulants, or anodynes may be useful.

If from debility, hypostatic congestion occurring, tonics, stimulants, and change of position will be demanded. If the congestion arises from the causes of inflammation, and constitutes the first stage of that process, it should be treated like the inflammation of which it is a part. When accompanied by a chill and rise of temperature, it demands the same treatment as the first stage of pneumonia.

As congestion of the lungs may be severe in its symptoms and con-

sequences and speedy in its results, there being great dyspnœa, cough, frothy expectoration, very rapid or panting breathing, a severe suffocating feeling, and, on auscultation, bubbling râles in the larger bronchi and snbepitant râles in the fine ones, with rough respiration, etc., thus presenting alarming phenomena, remedial measures should be promptly applied, so that, if possible, hemorrhages, œdema, suffocation, or pneumonia, may be prevented.

When not accompanied with a chill and rise of temperature, it is not the forming stage, and is not so likely to be followed by pneumonia. When, then, the blood is diverted by the means indicated above, relief is often prompt, and when the cause is not persistent, the relief is often permanent. When congestion constitutes the forming stage of pneumonia, it yields to the treatment for that disease more speedily and completely than when the pneumonia is more fully developed and further advanced.

TREATMENT OF ACUTE LOBAR PNEUMONIA.

On no subject of practical medicine have there been wider differences of opinion and more heated discussion than on the treatment of pneumonia. Extensive records of cases and results under different modes of treatment have been kept, especially in the great hospitals of Europe, and these have been adduced to prove almost everything ; but, taken together, they have settled almost nothing as to the best method of treating this very common disease. Nothing could illustrate more forcibly the imperfection of the statistical method of investigation than its application to the treatment of a disease like pneumonia, which occurs under such a variety of circumstances, presents such differences in types and stages, and requires discriminating adaptation of remedies to the different conditions. Statistics deal with numbers of cases, and when comparisons between different particular remedies or methods are made, the same remedies are applied to all the cases of the set ; and if all cases were in every respect alike, and if the same treatment were equally applicable to each, a sufficient number of faithfully recorded cases would furnish the data for just conclusions. This, however, is obviously not the case ; and even that which might be proven as best for the aggregate of cases, may be very far from proper for an individual case. Especially is it far from being conclusive that the course of treatment best or worst adapted to the average of cases in a great European hospital will be equally beneficial or injurious in an individual or in the aggregate of cases in American private practice.

But however imperfect the testimony of statistics may be, they are

not without a certain value ; and they must be regarded as having at least proved that in the practice of large European hospitals, taking long periods of time into the account, when patients from the destitute classes are received almost invariably in advanced stages of acute pneumonia, the treatment with bleeding, tartar emetic, and other depressing agents, indiscriminately and freely applied to all cases and stages, is much worse than no medical treatment, and that a much larger number recover under expectant management—with proper food and nursing—and without perturbing therapeutical measures. This, however, does not prove that blood-letting has no proper uses in the disease, or that all who use tartar emetic are in deadly error. It simply proves that to bleed all of this class of patients in the advanced stages of the disease is *bad*, and that antimony and other depressing agents, indiscriminately pushed, are nearly as objectionable.

Pneumonia, like other prevailing diseases, differs widely in type at different times and in different localities, depending upon the general condition of the people and the character of the specific cause which produces the disease.

When some cases in the same hospital, and at the same time, are bled or subjected to any other particular treatment while others are not, the comparative results are not conclusive as to the propriety of the bleeding or other treatment, unless it is shown that the cases were alike, for the bleeding or other measures of interference would be more likely to be resorted to in the severer cases. These considerations will serve to explain the unreliable character of statistics, and suggest caution in receiving their testimony.

In estimating the difficulties of determining the value of any course of treatment in pneumonia, the fact must be borne in mind that a large proportion of cases, if left to themselves, will run a comparatively mild course and terminate in recovery—often in a critical abatement of the fever, and the active course of the disease—in from five to ten days, and that also abortive cases sometimes occur where the termination is even at an earlier period.

We are sufficiently often told, at the present day, that pneumonia is a self-limited disease, running a specific course that must have its way, tending to recover by crisis, and that the object of treatment is to “conduct it through.” It is, however, stated that the time of that crisis varies from the second to the tenth day, which must be regarded as a course not very definite, and not altogether incapable of change. It is unquestionably true that about sixty per cent. of cases do thus terminate in a spontaneous cure within one, two, or three weeks, if left to themselves ; but the other forty per cent. do not thus

terminate; and the statistics of the Vienna Hospital, not under the care of any particular man, or kept to substantiate any theory or foregone conclusion, show that in 7,942 cases, left without medical treatment, 3,241, or 24.5 per cent., died from the immediate effects of the disease; while respecting those who suffered from chronic impairment and died from secondary or remote effects, the statistics are silent. It is to be presumed that the 15 per cent., the usual average of difference between those who speedily recover and those who speedily die, suffer more or less severely for an indefinite period, and many finally succumb to the disease or its remote consequences. It is a mistake in this, as in many other diseases, to regard escape from early death as a recovery.

It is doubtful if a lung which has undergone the process of hepatisation, remaining long in that condition, whether the method of removal of that state has been by absorption or suppuration, is ever perfectly restored to its previous conditions of vitality and structure. It is certain that in very many cases such restoration does not take place, and the lung is often left enfeebled and degenerated, and more liable than before to destructive disease.

For the sixty per cent. of speedy spontaneous recoveries, treatment may not be needed; but if there are any means of relief for those not thus recovering, they should be carefully sought for and promptly applied. It is for the forty per cent. not thus recovering that treatment is required, if treatment can be of any avail. It is impossible to know beforehand with any certainty what individual cases will prove to belong to this latter class, which, though a minority, still from the frequency of the disease amounts to an immense number in the aggregate. The impossibility of determining in the beginning of the disease what cases will soon recover spontaneously, and what will not, increases the embarrassment as to the course to be pursued; but the great importance of a correct determination as to what is to be done will be appreciated when it is borne in mind that more than twelve per cent. of the mortality from all internal diseases is from the immediate effects of pneumonia; and when the mortality from the more remote results—from the cases of phthisis and other chronic affections, and the diminished power of endurance of acute disease produced by it—is added, that percentage of mortality from pneumonia must be materially increased.

From the speedy and favorable termination of so many cases in the natural course of the disease, many remedies have gained a reputation which they have not deserved; and the frequent recoveries, notwithstanding even bad treatment, will account in part for the long persistence in the indiscriminate depleting course which some of the

ablest, most logical, and cautious investigators in the profession have pursued.

The importance of this subject requires a very careful consideration and somewhat full discussion in a work whose aim is not merely to express individual views, however firmly such views may be entertained and positively expressed, but to aid the reader in placing himself abreast with the best practical views of the present day. It has therefore seemed to me proper that the leading remedies which have been, and still are, in use in this disease should receive a somewhat particular notice.

Blood-letting.—One of the oldest and most extensively used remedies of the past in pneumonia is *blood-letting*. When such men as Louis, Grisolle, Wunderlich, and many others of equal authority, not only in the past but down to our present time—men of large opportunities, observation, and experience—insist upon the advantages of this remedy, and refer to what they regard as test cases in considerable numbers to sustain their conclusions, we are not authorized to totally discard the remedy as always and entirely injurious or even useless; and its claims should at least be considered, if not admitted. The views and practice of Laennec, of Broussais, of Louis, and of Bouillaud are familiar, and have been alluded to under the head of prognosis, and need not further be stated.

Grisolle, of France, a man of our day, gives 11 mild cases left to absolute expectancy, and 13 alleged to be of the same type treated by bleeding. In the former, convalescence began on the tenth day, and physical signs were protracted to the twenty-second or thirtieth day, while in those bled, the fever disappeared on the seventh day on an average, and the physical signs on the twelfth day. These, however, were selected cases, declared to be comparatively mild, and they were not sufficiently numerous or varied to prove the treatment generally advisable.

Wunderlich, of Germany, gives a total of 190 cases, with an average mortality in all of 11.57 per cent. Seventy of these were not bled, with a mortality of 17.10 per cent., while 47 were bled, with a mortality of 6.38 per cent. The numbers here are sufficient to justify conclusions; but the evidence that all the cases were alike, or even nearly alike, is wanting, and this evidence is essential for a just comparison of results.

One fact in the cases of Wunderlich is of much importance, as it seems to disprove the very current statement among authors that pneumonia cannot be cut short, or, as Jaccoud declares, “the natural evolution of the lesion cannot be abridged an hour.” Wunderlich states that in 18 cases the bleeding was performed on the *first* or

second day of the disease, and that of these there was an almost immediate cessation of the pneumonic process in 10, a crisis being induced on the second, third, or fourth day; and in five more a material diminution of the fever occurred. Ten out of 18 cases do not terminate so soon spontaneously. There is no lack of assertions that bleeding has little or no effect on the temperature; and often, especially after the disease is somewhat advanced, it has not. It can by no means be depended upon to arrest the inflammatory process after its full establishment, and it very frequently entirely fails to do so in its incipieney. But that it does so sometimes, I have evidence besides the statements of others; and the assertion that the course of the inflammation is never abridged, I am positive is wholly untrue. Those who make these assertions do not inform us of the time of commencing treatment, and it is well known that in the hospitals where the observations are made, the treatment is almost never commenced before the third, fourth, fifth, or sixth day of the disease. Any amount of general negative testimony from those whose practice is confined to hospitals and consultations, and who do not see pneumonias in their beginnings, will not outweigh the positive testimony of a competent observer who has used active remedies, as it seems Wunderlich did, on the first and second days, and has found in a large proportion of cases decided results. One thoroughly convinced of the impossibility of altering the course of the disease would not be likely to administer efficient remedies for that purpose, but with ideas of using simple palliatives he would wait for severe symptoms to occur before even these would be applied. I have no difficulty in giving credence to the statements and inferences of Wunderlich, though I am sure there are remedies much more certain than blood-letting to arrest the progress of pneumonia in its early stages, and which are not attended with its dangers.

The statistics of Dietl, which are frequently quoted, seem to contradict most positively those of Grisolle and Wunderlich. He gives 380 cases, 68 of which were bled, with a mortality of 20 per cent.; 106 where large doses of tartar emetic were given, with a mortality of 20.7 per cent.; while expectant treatment in 189 cases was followed by a mortality of only 7.4 per cent. I have no difficulty in giving full credence to these statistics, for it is presumed that the bleedings were practiced upon poor patients in his great hospital-wards, debilitated and often alcoholized before their attacks, where the disease had continued until hepatization had taken place, and a large quantity of the richest portions of the blood was taken from the circulation and solidified in their lungs; and the great wonder might well be that so many survived.

The statistics of Dr. Huss, from the hospitals of Stockholm, go to show somewhat better results when bleeding was abstained from than when it was indiscriminately practiced, and the statistics above referred to, together with those already given under the head of prognosis, indicate, so far as statistics can, with great positiveness, that only in exceptional cases, and in the earlier stages of the disease, is the use of the remedy called for.

It is proper, however, to mention as an offset to some of the statistics given, and as further illustrating the variations in the disease and the uncertainties of statistics, that Skoda states that in 1840 he treated sixty-four females by large bleedings and tartar emetic, with only one death, though in the same year, among males, there was a mortality of 12.5 per cent.

Many who strenuously oppose bleeding in all ordinary cases, still advise it for some particular symptoms.

Jaccoud says it should be practiced when dyspnoea is extreme.

Fothergill says that when "both lungs are affected, so that the pulmonary circulation is much obstructed, it is good treatment to bleed freely, so as to lessen the bulk of the blood and secure a nicer adjustment of balance betwixt the blood and the respiratory powers than existed before." He adds: "The bulk of blood must be reduced at all risks," and the hazards of depression must be met by stimulating and sustaining measures.

Sir Thomas Watson, with his usual clearness and discrimination, says: "When with physical evidence of pulmonary inflammation you find your patient breathing with extreme labor and difficulty, and you notice, at the same time, the tokens of enormous venous congestion, the veins of the head and neck tinged with dark blood, while the pulse is very feeble as well as frequent, you may conclude that the right side of the heart is so distended with blood as to be unable to contract, and you must take blood by venesection, with the chance of so saving your patient's life, and with the certainty of prolonging it and of giving immediate relief. * * * I believe this the only accident of pneumonia that requires or warrants recourse to general blood-letting."

Niemeyer gives three conditions when venesection ought to be practiced, viz., 1st. When it attacks a vigorous and hitherto healthy person, is of recent occurrence, and when the temperature is higher than 105° F., and the pulse more than 120. 2d. When collateral œdema in the lung not inflamed is causing danger to life, indicated by great frequency of respiration early in the disease, not traced to fever, pain, and to the extent of the pneumonic process alone, and as soon as a serous, foamy expectoration appears, with a respiration of

forty or fifty per minute, and when the rattle in the chest does not cease for a while after the patient has coughed, we ought at once to practice copious venesection. The other indication for bleeding arises from symptoms of pressure upon the brain—not headache and delirium, but a state of stupor or transient paralysis.

Dr. Lebert, whose opinions I regard as valuable, says the indications for venesection are a pulse full and hard, or small and resisting, with marked dyspnœa and a cyanotic condition, all of which point to great embarrassment of the pulmonary circulation. If there be rapid spread of inflammation, marked cerebral symptoms, and distention of jugular veins, blood-letting is imperatively necessary. It is, however, contra-indicated in secondary pneumonia, in typhoid forms, in drunkards, and in epidemic or malarious forms of the disease.

In this country Prof. Flint (*Practice of Medicine*, fifth edition, p. 172) says: "It is admissible in certain cases as a palliative, and perhaps to some extent as a curative measure, in view of the promptness of its operation. The circumstances which warrant its employment are: high fever, the pulse more or less resisting compression—in other words, arterial tension—and a robust constitution." As a rule he prefers other means for fulfilling the indications which bleeding accomplishes, even in the class of cases mentioned; and of course regards the bleeding contra-indicated in the opposite conditions. He thinks it at least possible that occasionally it produces an abortive effect, but does not think it can be depended upon for that purpose.

Dr. Loomis, of New York, advises bleeding when the conditions mentioned by Watson are present; and Drs. Gross, Hartshorne, and Pepper, of Philadelphia, are favorable to occasional bleedings in the disease. The latter believes that a prompt venesection before the stage of hepatization occurs may possibly abort, or, at all events, limit the extent of the inflammatory process. When the inflammation is fully developed, he regards it as of doubtful propriety, and to be practiced only when the right heart is overloaded, and even for this he thinks the relief transient.

Dr. Wilson Fox discourages the practice of venesection for those conditions of collateral congestion and œdema where Watson, Niemeyer, and Lebert regard it as so important, thinking the effect is but temporary, though he acknowledges that he has had no experience or observation of the effects of bleeding in such cases.

My own experience and observation have extended back to the time when repeated bleedings were practiced in pneumonia, and I have seen much blood drawn in these cases. That I have seen great temporary relief afforded by bleeding, I can most positively assert. That in some cases of sthenic pneumonia, in the *early* stages, permanent

good has been done, I believe. In the exceptional cases described by Watson, Niemeyer, and Lebert, I would still try bleeding to gain time, though the effect might be temporary; but as a general practice, however early in the disease or vigorous the patient, it is, at least in most cases, unnecessary, and I would not resort to it, as we have now far more effectual remedies, both for the relief of the symptoms and the arrest of the disease; and in the advanced stages of the affection it is, as a rule, exceedingly pernicious if carried to much extent, so that as a common practice it is to be condemned. It certainly cannot be relied upon as an important item of standard treatment in the mass of cases of pneumonia.

In positive plethora, when there is a superabundance of blood in the system, the quantity may certainly be lessened without detriment, in whatever condition of health or disease, but otherwise bleeding should be practiced only when clear indications for it are presented, and when rational pathological and therapeutical considerations are confirmed by the results of experience.

An occasional bleeding in a vigorous subject, in the early stage of the disease, may be useful, and sometimes in the severe congestive cases at a later period, and it is justified by rational principles and the results of experience; and the former abuse of the remedy is no justification for its total abandonment and condemnation.

Much that has been said respecting the use of blood-letting will apply to that of free doses of *tartar emetic*. The opposition to this remedy, which a few years ago went to an extreme, is yielding in Paris to a favoritism which may go to the other extreme. That it sometimes produces a feeling of relief, often diminishes the force and frequency of the pulse, increases perspiration and lowers the temperature, there can be no doubt; but it depresses the nervous as well as the vascular system, impairs the nutrition, and when long continued induces spanæmia. Not unfrequently it irritates the gastric and intestinal mucous membrane, and by these various actions tends to increase in the latter stages the danger of collapse. That in vigorous subjects and sthenic cases, where there is no irritability of the gastrointestinal membrane, and in the absence of more efficient remedies, it may be of service, I am not prepared to deny; but statistics, as we have seen, show, if such statistics can prove anything, that its free and indiscriminate use is only somewhat less injurious than free and indiscriminate bleeding. As with blood-letting, it cannot be relied upon as a general efficient curative, or even palliative, agent in pneumonia.

I must, however, say that in the forming stage of what certainly appeared to be acute pneumonia, I have seen the operation of an

antimonial emetic apparently check the progress of the disease. On the other hand, I have seen it fail to do so, and prostrate unduly the strength of the patient and produce serious gastric irritation. The use of this article in large doses, so managed as to secure a tolerance of it by the stomach and produce a "contra-stimulant" effect, is no longer urged, as was the case years ago, and need not be described. In small and repeated doses, it has not a little testimony in its favor, but its beneficial effects in ordinary cases are, on the whole, exceedingly questionable.

Calomel given in doses to procure its constitutional effects has fallen into disuse, and probably justly; for although in sthenic cases it may render the exudate, which is hard and tenacious, more diffuent and promote its absorption, yet in quantities sufficient to produce this effect it impoverishes the blood and reduces the system even more than a moderate amount of blood-letting or of antimony. There is not sufficient evidence of its beneficial effects to justify the risk of these injurious consequences, and this article must be set aside as not to be relied upon as a principal remedy in the disease. Its use to the extent of modifying the secretions, in conjunction with other remedies as a cathartic, may be of essential service, and its administration in this manner is not unfrequently called for.

Alkaline and *saline* remedies have a reputation, and were the chief medicines given by Dr. Bennett, of Edinburgh, in the cases in which he had such remarkable success in the treatment of this disease. The salts of potash and soda, with organic acids, are chiefly advised, and their eliminative effects are often useful. In the latter stages of the disease, when the more acute inflammatory symptoms have passed, and the exudates linger in the lung tissue, I have no doubt of the power of iodide of potassium to promote their liquefaction and absorption. Given in doses of from five to twenty grains four or six times a day, sometimes combined with other salines, as the acetate of potash or a salt of soda, the alterative, sorbefacient, and eliminative effects are often decidedly conspicuous. These articles cannot be relied upon to exert much influence upon the course of the inflammation, but they eliminate effete matters from the system by increasing the glandular secretions during the progress of the inflammation, and aid in removing its consequences.

The *salts* of *ammonia* have long been in use in pneumonia, and have of late been much commended. The hydrochlorate has been a particular favorite with many of the German physicians, and the carbonate, especially in the low forms and latter stages of severe cases, has been used with advantage. From its volatility the doses must be quite frequently repeated to keep up the effect. It is frequently given

in a solution of acetate of ammonia, where a diaphoretic effect is desired, or in cases of exhaustion, in egg soup with wine or spirits. It is thought especially to prevent a tendency to the formation of heart clots, which are sometimes a cause of death, and it would have an equal tendency to prevent thrombosis in the blood-vessels.

A few years ago the *veratrum viride* had an extensive "run" in this country, not in pneumonia alone, but in all inflammations and fevers where a strong and rapid pulse and great heat were present. It is a cardiac and arterial sedative of much power, and where the pulse is *strong* and *rapid*, it will reduce both its strength and frequency; and when carried to sufficient extent will generally produce perspiration and lower the temperature. It often produces distressing nausea and a free secretion from the throat and air passages; and, when its action is carefully watched, and it is judiciously administered, it may produce beneficial effects. It has this advantage over tartar emetic, that its depressing effects are more readily counteracted by opiates and stimulants; it is not in the same manner spanæmic, is not as likely to produce permanent irritation of the stomach and intestines, and is in every way less permanent in its depressing effects. As it is a cardiac and arterial sedative, it is inapplicable and contraindicated in those latter stages of pneumonia when, as is so generally the case, the heart's power begins to fail, and its action is feeble though rapid. There can scarcely be too great caution in its use in this stage of the disease and condition of the heart. Its action is quite different from digitalis, with which it is sometimes classed. This latter article renders the action of the heart less frequent, but it increases its tonicity, and, if not given too freely, aids it in carrying on the circulation; while the *veratrum* enfeebles its action in every respect, diminishing its tonicity as it lessens the frequency and force of its rhythmical contractions. From these statements it will be seen that it has a range of applicability, and in the absence of better remedies may be usefully employed. I believe it is sometimes capable of even arresting the disease in its early stage, if carried to the extent of profoundly impressing the nervous system; but as there are other remedies much more likely to produce that effect, and with less unpleasant consequences, it should not, certainly as a rule, be chosen for such an attempt.

Aconite operates in a manner very similar to *veratrum viride*. Moderate doses reduce the heart beats, often remarkably; but with larger and dangerous doses, while the power of the heart is still further reduced, its pulsations are faster, and often become irregular; and even a small quantity will sometimes produce irregularity of the

heart's action. It is capable of diminishing fever heat, but it does so chiefly by slowing and weakening the heart, though its diaphoretic effect contributes to that result. In this manner inflammation may be abated ; but its use is attended by the same drawbacks as that of *veratrum viride*, and it must be given with the same cautions and restrictions. It is more applicable to the treatment of inflammations where there is not the same danger of failure of the heart's power to do its increased work as is the case in pneumonia, and its use, as a rule, must be confined to the early stage of this disease, before the obstruction of circulation through the lungs has rendered it improper to diminish so much the force of the heart.

Alcohol in pneumonia has its advocates and its opponents. That it is capable, when given in free doses, of diminishing temperature and modifying, sometimes favorably, inflammatory processes, there is reason to believe ; and that in the later stages and in depressed conditions, by its narcotic effect in relieving shock, it may increase and sustain the action of the heart, and possibly by a more direct effect upon that organ may increase the vital activities, very many most strenuously contend. Whether it produces a direct stimulating effect in disease, a thing it does not appear to do in health, or whether its apparent stimulating effect is by relieving shock or by paralyzing inhibitory nerves, is a question by no means settled. My own opinion decidedly inclines to the latter conclusion. But in whatever way it operates it seems sometimes to have a beneficial effect, especially in those who have been accustomed to its use ; and the weight of professional opinion will not allow it to be entirely discarded, though I do not doubt that its virtues have been greatly overestimated. Very few of its advocates think it capable of arresting the disease or curtailing its duration, but believe it may enable the system to endure it. Even this view can hardly be sustained by comparison of cases and statistical evidence ; and its exact value, or want of value, in the treatment of pneumonia, must be left for the future to determine. When the heart's action wavers and fails from the shock of the disease, alcohol stands among the therapeutic agents for counteracting the depression.

Chloroform inhalations have been used, and a few years ago were strongly recommended not only as a remedy for palliating the cough, but for curing, or at least abating, the disease. That they will often relieve an irritable cough is certain, and by their soothing narcotic effect they may mitigate other morbid conditions. The test of general experience has not, however, been applied to them, and of late little is heard of their use.

The *Chloral Hydrate* would produce similar general effects, but the

dangers of this article are such as to require great caution in its use in this disease.

Digitalis in pneumonia has been long and extensively used, and has lately been the subject of careful observation and trial, especially among some eminent German physicians. It has distinctly recognized powers in reducing temperature, especially in typhoid fever, but it is thought to a less extent in pneumonia. Its well-known effect in slowing the pulse and increasing the tonicity of the heart may render it applicable to those cases where this organ is relaxed, with a rapid and feeble action. It is, however, somewhat slow, and is often uncertain in its action, and when pushed for speedy results is sometimes cumulative in its effects, producing too great slowing, and often intermittence of the pulse, and disturbing very unpleasantly the nervous system. My experience with *digitalis* does not justify me in speaking highly of its general use in cases of ordinary acute pneumonia; but in those more chronic and congestive cases dependent upon obstructive disease of the left side of the heart, I can hardly speak too strongly of it, used in connection with the elixir phos. of iron, quinine and strychnine, and persevered in for some time.

Opium is an important remedy in pneumonia, as in so many other morbid conditions. Its power in modifying inflammatory processes, especially in their early stages, has already been repeatedly mentioned. It is as effectual in its action upon inflammation of the lungs as of other organs.

In all the cases where respiration is not so much interfered with as to produce danger from apnœa, opium may be given when indicated by pain, restlessness, or excessive cough. When, however, cyanosis occurs or is threatened, or when accumulations take place in the bronchi which render cough and expectoration important, opium must be cautiously given or withheld, as it diminishes respiration and may increase the tendency to apnœa. In the early stage of the inflammation, before effusions and hepatizations have occurred, free doses of opium will not only relieve the pain and other distressing symptoms, but will very generally markedly check the fever and inflammation, and will not unfrequently abort the disease. For years I was in the habit of administering free doses of morphine and ipecac., or large doses of Dover's powder, producing a decided anodyne, narcotic, and diaphoretic effect, with the result of very frequently, I may say generally, materially mitigating, and sometimes speedily aborting, the disease. In combination with quinine, opium is exceedingly useful in arresting this as well as many other forms of inflammation.

The use of *Cold externally* has attracted attention of late, and has been a subject of observation and discussion since the time of Priessnitz;

and the external application of water has been used in a great variety of diseases, acute and chronic, and its value in many cases has been abundantly demonstrated. Its utility in typhoid fever, certainly when used in connection with other items of the antipyretic treatment, must be regarded as established, though its exact value, the conditions of its most successful use, the conditions and frequency of its failures, and the extent of its dangers are yet to be determined. There has not as yet been the same extensive experience in the use of cold in pneumonia as in typhoid fever. The views on this subject, and the experience of Liebermeister, Juergensen, and Ziemssen, with the cold bath, as presented to the profession in this country in the translation of Ziemssen's *Cyclopædia*, are well known. There have been timidity and reluctance on the part of many in adopting the treatment there advised in typhoid fever, and still more in pneumonia; and I found, during a recent professional tour in Germany (summer of 1880), that many expressed doubts as to its utility or safety in some cases of typhoid fever, and especially were doubts expressed from very high sources respecting its general application in pneumonia. The views of Juergensen were by many regarded as extreme, and the practice of the cold bath, to the extent advised, unsafe. Others of equal authority, and more practical experience in its use, fully sustain the views, and confirm the results as published by Juergensen, and some go even further than he in their opinions, recommendations, and practice.

As a specimen of the most favorable opinions of the use of the cold bath in croupous pneumonia, I quote from a private communication from Prof. Gustav Huguenin, of the University of Zurich, already referred to and quoted from in the article on typhoid fever. He says: "Every severe case of croupous pneumonia is to be treated in the same manner as typhoid fever in all the details. In pneumonia particularly, the treatment must be applied with energy and persistence. In other words, the cold-water treatment must at once be considered the *all-important* matter, and not come in as an auxiliary. When there is debility of the heart here, it is to be treated as in typhoid fever, by stimulants, in connection with the bath—before and after—by wine, rum, or brandy with tea. During the bath, which is of a temperature of from 12–15° C., or 54–60° F. where the patient is robust, but if delicate and anxious, from 20–25° C., or 68–77° F., cold water is to be added till the temperature is brought down to from 16–12° C., or 61–53° F., and the length from five to twelve minutes; the pulse and color of the skin are narrowly watched, and the patient removed or stimulants given as may be required."*

In Bellevue Hospital the "cold pack" in pneumonia has been very recently introduced, and with such results, it is reported, as to con-

* Tepid baths at a temperature of from 88° to 96° F., the patient remaining in the water from two to four hours at a time, twice a day, have been lately used in typhoid fever with reported

vince the attending physicians of its utility. Whenever the temperature rises to 103° F., or more, the patient is placed on a water bed with a wet sheet wrapped about him, which is sprinkled with cold water every fifteen minutes, and he is kept in the pack until the mercury reaches 101.50° F. In no case was it necessary to continue the pack over two hours, and the temperature was kept down by the pack alone until convalescence occurred, which seemed to take place in all the cases reported as thus treated. Milk was allowed in as free quantity as could be digested, and half an ounce of whisky was given once in two hours where a heart stimulant was indicated. In the severe cases quinine was administered in ten-grain doses, repeated once or twice; and an expectorant mixture, each dose containing five grains of carbonate of ammonia with fifteen drops of spirits of chloroform, every two hours. The quinine was thought to make more permanent the reduction of the temperature effected by the pack, and the expectorant mixture to render the sputa less tenacious.

From these sources no accidents from the bath or pack are reported; but seriously depressing effects are said to have occurred from this treatment in the hands of others. The question as to the propriety of this treatment is not yet finally settled, but it is hoped it will be in the near future.

The application of *Blisters* to the chest in pneumonia is of doubtful propriety. As a rule they should be omitted; but where the pleura is involved, and the pain lingers after other symptoms have abated, and especially if there be evidence of effusion from the pleura, blisters may be applied. Counter-irritation by iodine, etc., may sometimes be substituted, and sinapisms often appear to give relief to pain.

Fomentations with the impervious silk jacket are less objectionable than blisters; and where the cold bath or pack is not used they will not interfere with other means. They often produce a soothing effect and procure relief, and may with great propriety be applied.

The treatment of pneumonia with *Quinine* is a subject of much interest and importance, and requires to be carefully considered. In the preceding discussion of the different remedies which have been used in pneumonia, it must be seen that no one, unless it should prove to be the cold bath or pack, can be relied upon as cutting short the disease, or as very materially altering its results, though a judicious combination of methods, and a careful use of these different remedies, adapting them to the particular conditions presented, may result in decided benefit.

The use of quinine as a remedy in inflammation, and especially when combined with morphine—its power of arresting inflammations in their early stages—I have repeatedly mentioned in the preceding

gratifying results: and this modification may be found equally if not more applicable to cases of pneumonia.

part of this work. All that has been said on this subject applies with full force to pneumonia—indeed is typically illustrated in this disease. These views I have entertained, but with increasing clearness and positiveness, for the last twenty years. They have been put in constant practice, have been taught to successive classes of students, and have from time to time been expressed in medical journals; and a more particular account of the treatment of pneumonia with quinine, aided by morphine, was presented to the American Medical Association, and published in their Transactions in 1877.

I shall make use of portions of this article in what I have now to say.

The efficacy of bark and quinine in some forms of pneumonia and other visceral inflammation, especially when connected with malarial fever, has been recognized for a long time. Laennec refers to a "Treatise on Simple and Pernicious Intermittent Fevers," by M. Bailly, published in Paris in the year 1825, in which it is stated that in the pernicious fevers of Rome there is an "absolute necessity of administering the bark, in order to check the progress of the fever, even in cases complicated with the greatest visceral inflammation"; and the works of Morton, Torti, Quarin, and others are referred to as presenting the same views. Laennec himself speaks of cases of pneumonia and other inflammations which were treated by "bleedings too frequently repeated, and by cinchona given in too small doses, and left off too soon."

He again says: "We sometimes even meet with epidemic peripneumonias in which blood-letting is constantly hurtful, and the bark beneficial in every stage of the disease. This fact, which cannot be denied, was frequently witnessed in Germany toward the close of the last century. Numerous examples of the same kind are recorded in the old *Journal of Medicine*; and I have myself met with many, particularly in the epidemic among the troops in 1814, already mentioned. * * * To be effectual it must be given to the extent of an ounce of the powder or an equivalent portion of the extract daily. In several cases I have continued to give the *sulphate of quinine* for more than a month, to the extent of eighteen grains in the twenty-four hours." He adds, that "opium has sometimes been employed with success in the same circumstances as the bark." *

Among the more recent authorities Dr. Wilson Fox, in his article on pneumonia, in *Reynolds's System of Medicine*, says: "Pneumonia complicated with intermittent fever requires the use of quinine.

* Laennec on Diseases of the Chest, etc., translated by John Forbes, M. D., London, 1827, page 243 *et seq.*

Huss recommends that eight grains should be given during the rigor, and repeated in the sweating stage." (Volume v., page 707.)

Dr. Fox also, in speaking of a form of intermittent pneumonia, remarks : " It is said that quinine, if given early, *will cut the disease short* ; but if this is not effected, the pneumonia tends to become double, and of a dangerous character." He refers to Morehead on Diseases of India, and the other works as quoted by Grisolle. (Reynolds, volume v., page 661.)

Niemeyer speaks of " the bold administration of quinine and iron " as peculiarly appropriate in some cases of pneumonia, required from the " very outset of the attack ;" and he classes quinine with veratrine and the inhalation of chloroform as febrifuge agents in the active forms of the disease. " By these agents," he says, " the action of the heart and the temperature can be reduced, and the fever moderated, but they have no immediate local influence upon the nutritive disorder." Dr. Fox, however, in speaking of veratria, says: " In some it appears to accelerate the period of the crisis, and Kocher is of opinion that it also shortens the duration of the process of resolution ; while in a few cases, when given early, it appeared to *cut short* the disease, and to prevent the occurrence of consolidation." It is this latter effect which I now claim for quinine.

Dr. F. T. Roberts, in his *Theory and Practice of Medicine*, says: " If there be high pyrexia in pneumonia, full doses of quinine may be tried." And Dr. J. S. Bristowe, in his recent work, speaking of the same subject, says that with the object of reducing the temperature the " cold bath, quinine in large doses, veratria, digitalis, and aconite " may be used.

The views of the writers of this country in our standard works and medical periodicals are too well known to need quotation. The experience in the army, during our late war, has modified professional opinions on various important subjects, and on none, perhaps, more than on the therapeutical effects of quinine.

The influence of Peruvian bark and its derivative in diminishing directly the phenomena of fever—as an antipyretic—though by no means a recent discovery, has been more prominently brought before the minds of the profession of late by the writings of the German physicians, and particularly by those of Liebermeister and Juergensen in Ziemssen's *Cyclopædia*. I need not detail their views, since by the enterprise of the American publishers a translation of this great work has been placed within the reach of the masses of the profession ; but the views of Juergensen upon pneumonia and its treatment with quinine are so forcibly expressed, and his statement of his experience of its effects is so striking, as to challenge somewhat particular

attention. As is well known, he holds that croupous pneumonia, though not contagious, is a general and specific disease, or, as he expresses it, "is a constitutional disease, and is not dependent upon a local cause. The pulmonary inflammation is merely the chief symptom, and the morbid phenomena are not due to the local affection." He contends that it belongs to the "group of infectious diseases"—that it cannot be produced by any of the usual causes of inflammation—that there is no constant relation between the local and febrile symptoms—that it runs a typical course, and that, as in other diseases depending upon a special exciting cause, as typhoid fever, or the exanthemata, "nature cures, the only duty of the physician is to maintain life until the cure is effected." He declares, in emphasized types, that "this is the principle which underlies the management of all acute infectious diseases, and is applicable here unconditionally." He farther teaches that in "croupous pneumonia the danger threatens principally the heart of the patient"—that "death results from insufficiency of the heart"—and that "the fever is the chief cause of the heart's failure." "The fever," he adds, "induces increased labor on the part of the heart, and at the same time inflicts a direct injury upon it," produces feebleness and degeneration of this organ, and consequently "the fever is the first point of attack for treatment." He regards as the proper means for subduing the fever the application of cold by means of the bath, but more particularly the use of large doses of quinine. This article, he declares, unlike nearly all other antipyretic remedies, "reduces the fever without enfeebling the heart."

I regard most of these positions as well taken and correct; and his statistics showing the success of his mode of treatment compared with other plans mentioned are very striking, if not conclusive, as to its superiority over them. But my experience compels me to take issue with the doctrine, that croupous pneumonia must run its course—that it cannot be interrupted—and that the *only* duty of the physician is to maintain life until that course is completed.

On the contrary, as already intimated, I cannot doubt that quinine is capable, when properly used—certainly in the early stage of the disease—of arresting its progress in a large majority of cases, not only mitigating the fever, but preventing the full development of the local inflammation.

This conclusion is based upon my own personal experience—upon observations carefully made; and these have continued through so long a period, and involved such a number of cases where the diagnosis was unmistakable, as to exclude the possibility of doubt. I am gratified,

too, in being able to say that many who have resorted to this practice have reported to me similar results.

I am much gratified to observe that these views of the efficacy of quinine in arresting the early stage of inflammation, and especially of pneumonia, are being accepted by a large number of the most prominent American physicians, some of whom may have preceded me in entertaining these opinions and pursuing this practice. Although I had for many years noticed the striking effects of free doses of quinine in arresting pneumonias complicated with malarial fever, my attention was more particularly called to the fact that it was not in malarial cases alone that quinine exerted so much influence upon the disease, by Dr. U. Upjohn, a physician of local reputation and large practice in the western part of Michigan. His method was different from that I have since pursued, but the same result was accomplished.

More recently Prof. Flint seems to have adopted the same views which have for many years guided my practice and teaching. In his recent work on *Clinical Medicine* (1880) he says: "That quinine is successful in rendering the disease abortive in a certain proportion of cases there can be no doubt." During the past few years the author has observed instances too numerous to be accounted for on the supposition that the abortion was spontaneous. For this object from twenty to forty grains of the remedy may be given to an adult, either in a single dose or in two or three doses during the day.* In the fifth edition of his work on the *Practice of Medicine* (1881) he says: "Full doses of quinine, that is, from twenty to forty grains, given at once or within eight or ten hours, may arrest the disease. This statement is based on my own experience, as well as on the testimony of others. If a patient be seen in the first stage, an effort should be made to render the disease abortive by means of this remedy, inasmuch as it does no harm, aside from the annoyance of cinchonism, if it does not succeed; on the contrary, a favorable influence upon the course of the disease is produced, either by its antipyretic effect or in other ways, when it fails as an abortive remedy." (P. 173.)

Prof. Bartholow, in his *Practice of Medicine* (1880), says: "If cases [of pneumonia] are seen at the beginning, during the state of congestion, the author believes that much may be accomplished in an ordinary case by a full dose of quinia and morphia (ʒj, gr. ss.), the applications of cups or leeches, and small and frequently repeated doses of the tincture of aconite root (two drops every two hours)."

It may very naturally be thought that after Jørgensen's extensive use of quinine, his statement that pneumonia cannot be interrupted

* *Clinical Medicine*, p. 88.

in its course is very strong testimony against the abortive effect of *this* article at least. And so at first view it seems to be. But, as is the case with nearly or quite all the Europeans who write our books, his practice, upon which his facts and his statistics are based, has been in the hospital of a large city; while such private practice as he may have had has been in consultation. In such practice one very seldom sees pneumonia in its early stages.

In a large European hospital, patients with medical diseases are almost never seen by the attending physician of the hospital until the disease, if it be acute, has made decided advancement. There is first a delay on the part of the poor patient or his friends in calling for aid. The first physician called usually undertakes the case; but, discovering its serious character, advises the removal to a hospital. An official, or some authorized person, is then called upon, delays occurring at every step, and thus some days usually pass before the patient is actually in his bed in the ward, and still further time elapses before the physician at his regular days or hours of attendance arrives at the bedside of the sufferer.

In consultation practice the consultant is very seldom called upon until the case is not only serious, but, if acute, advanced; and in pneumonia, after hepatization or suppuration has occurred, or any material structural changes have taken place, more or less *time* will be required for the removal of morbid processes and their effects.

Moreover, with the belief that the disease cannot be arrested, and that the treatment is only to be resorted to for palliative purposes, and only when the severity of the fever threatens the exhaustion of the heart, the quinine would not be likely to be immediately given, even if the patient were seen in the very early stage; and it is then alone that a speedy and complete arrest can be expected.

Should the inflammation by the treatment be ever so speedily brought to an end, after from five to eight days' continuance, the period for its spontaneous cessation would be likely to be regarded as having arrived, and naturally, as many cases run their course in this time.

It may be presumed, then, that Juergensen has not tested, certainly on a large scale and under favorable circumstances, the treatment I shall soon more particularly describe; and when the disease soon subsided after the use of the quinine, we may presume the result was attributed to the spontaneous crisis.

The unsoundness of the position that, because pneumonia is regarded as a specific "malarious" or infectious disease, therefore it cannot be arrested, will be evident by calling to mind the single fact,

that the common malarial or paludal fever is universally acknowledged an infectious disease—one depending upon a peculiar poison, and having a specific type—but that it is more under the control of abortive remedies than any other general disease whatever. One of the diseases with which Juergensen would like especially to have pneumonia classed, is acute articular rheumatism; and all who have had experience with the proper full doses of salicylic acid, or salicine with the addition of alkalies, in this disease, well know that “flannel and six weeks” is not the most efficient remedy for this specific affection. Juergensen himself tells us that there are spontaneously abortive cases of pneumonia; and if some cases, even violent in their onset, the chill being decided, and the temperature running as high as 105.8° Fahrenheit, and above, may be “immediately succeeded by a rapid defervescence, so that the normal temperature be reached by the second or third day,” is it not probable, or at least possible, that medical treatment may produce a similar result in other cases?

This is a matter to be determined by *experience*, and not by *a priori* or analogical reasoning. And certainly no analogical reasoning can settle this question when a large part of the analogous cases are entirely ignored. Indeed, one of the great hopes for the medicine of the future is in the discovery of antidotal remedies, which by destroying specific poisons shall arrest specific diseases.

Pneumonic fever is not of an obstinate type. This is distinctly stated by Juergensen himself. There are several articles of the materia medica which, when properly used, under favorable circumstances, have the power of arresting this fever. They are agents which make a strong impression on the *organic nervous centres, the morbid conditions and actions of which are now, with the greatest reason, believed to be the more immediate cause of the pyrexial state*. Opium in free doses, as already stated, will often arrest the fever. Many believe that veratrum viride, or aconite, or alcohol in free narcotic doses will have that effect. All these agents, and others under certain circumstances at least, are capable of markedly diminishing feverish temperature and the associated morbid actions; but most of them are apt to depress the heart's action to such an extent, when given in full antipyretic doses, as to render them dangerous by inducing collapse. But quinine reduces fever without in the same way depressing the heart's action.

Quinine not only reduces the fever, which is an essential element in inflammation, but it has a special tendency to relieve internal congestions; it brings the blood more freely to the surface, and induces perspiration; and, if we can rely on modern experimental observations, *it diminishes the production and the amœboid move-*

ments of *leucocytes*, and thus diminishes exudation—another important element of the inflammatory process.

If fever and the other inflammatory elements depend upon the wrong action of the nervous system, as many of them certainly do, we would naturally look to neurotic agents to modify and control them. The term “antiphlogistic,” indicating opposition to inflammation and feverish excitement, long meant bleeding, purging, antimony, mercury, and salines. To my mind this term now means rather *opium*, *quinine*, *salicine*, *veratrum viride*, *aconite*, and other *neurotics*—articles capable of acting powerfully upon the nervous system; and, through it, upon the febrile and inflammatory processes.

In the treatment of pneumonia by quinine, as in the treatment of every other disease by active remedies, everything depends upon the dose, the time, and other circumstances of its administration. Jørgensen's method is to use it in connection with the cool or cold bath, the quinine aiding the bath in the reduction of the temperature. He says: “In addition to the direct abstraction of heat, I always use quinine. Above all other antipyretic medicines it possesses the invaluable advantage of reducing temperature without injury to the heart, and this is accomplished by diminishing the production of heat.” The dose he advises is from twenty-five to forty-five or more grains, given at once or within a few minutes. This reduces the temperature in a short time, and keeps it reduced for from twelve to forty-eight hours, its greatest reduction (from 2.7° to 4.5° Fahrenheit) occurring in from five to seven hours after the dose is taken. He advises that the dose be not repeated until the temperature again rises, and generally not before forty-eight hours. He recommends at the same time nourishing food, and, when the bath is used, “light wine.” He adds: “There is no doubt that alcoholic drinks *lower* rather than *elevate* the temperature, and it is more than probable that the alcohol acts as a direct preservative of the tissues. The former prejudice, which is still prevalent, has been shown by Bouvier and Binz to be unfounded.” The alcohol is given, then, to aid the quinine in *reducing the temperature*, and for the purpose of arresting too rapid destructive metamorphosis of tissues.

He strongly advises the use of morphine or chloral hydrate, as may be required to relieve pain and procure sleep, not seeming to fear the depressing influence of these articles on respiration; and when the heart's action actually fails, he resorts to musk and camphor in addition to the other means.

This method of Jørgensen, now so well known to the profession, I have thus briefly introduced in order to compare it with the one which I venture to present.

The particular method in the treatment of common pneumonia, which for several years past I have pursued with such results as to induce me to strongly recommend it to others, is briefly as follows :

When called to a patient within twelve or twenty-four hours after the chill, or at any time before any considerable exudate has occurred, I immediately give from six to ten grains of quinine, together with from one fourth to one third of a grain of morphine, which almost invariably in a short time—from half an hour to two hours—induces free perspiration and a reduction of the temperature. I then repeat the *quinine*, in doses of from four to eight grains, once in from two to three hours, and, unless all pain and special uneasiness are relieved, I add another, but usually smaller, dose of morphine in four or six hours, but by all means continuing the quinine in one of the last-mentioned doses until from thirty to fifty, and sometimes sixty, grains are given. Sometimes from twenty to twenty-five grains will be sufficient, given in these divided doses ; or if preferred, as it is by some, in doses somewhat smaller but more frequently repeated. But as the larger quantity is usually innocent and may be needed, I prefer to give at least thirty, and oftener as much as forty, grains in from twelve to twenty-four hours. The effects desired, and certainly as a rule produced, are a decided reduction of temperature, a marked diminution in the frequency of the pulse, a decided moisture of the skin or free sweating, a slower and more easy respiration, or relief from pain and the feeling of fulness in the chest, a diminution of the cough and of the tenacious and bloody character of the expectoration ; and, in short, not only is there a checking of the fever, but of all the evidences, general and local, of the pulmonary engorgement and inflammation ; and the quantity of medicine to be given will depend much upon the completeness of these effects produced.

The slight deafness and ringing in the ears, which may or may not result from these doses, is a matter of very little consequence, is almost always quite temporary, and *should have no influence in determining the quantity to be given*. A small quantity of quinine will produce these phenomena with some, while large doses will fail to do so with others, and neither in pneumonia nor ague *are they the measure of the medicinal effect of the remedy, or an index of the quantity that will be required or borne*.

As a rule, all the treatment required after this will be a gentle laxative, or, if the tongue be much coated, a few grains of blue mass, followed in a few hours by a mild saline cathartic, and this, in turn, followed by some mild eliminative mixture.

There may be cases, however early undertaken, that will resist this treatment ; but in those occurring under my observation the

results as indicated have followed, with scarcely a single well-marked exception, whenever the plan has been fairly and thoroughly carried out. The cases have been virtually *aborted*, convalescence has speedily occurred, and nothing more than a moderate congestion of the lung has remained, and this only for a few days.

If the treatment be commenced much later, and especially after hepatization has occurred, and the dyspnœa is marked, the morphine must be omitted or be given with more caution, but *the quinine is to be given in the same way*; the result very generally being to *bring down the temperature and check the extension of the disease*; but of course not so speedily to remove all its consequences. If much structural change has occurred, time will be required, and there will be a continuance of more or less pathological action before the lung is restored to its normal state.

In my judgment, at whatever stage of the disease a patient is seen, the quinine in these free doses should be given, and the full physiological effect as described should be obtained, the disease, by such treatment, being favorably modified if not arrested in its progress.

The comparative effects, in these advanced stages, of Juergensen's method and that I have followed, I am not able to state.

Having commenced the treatment with quinine some years before knowing of Juergensen's method, and having been satisfied with the results, I have not tried the plan of that distinguished author. That the subsequent course of the disease is usually materially shortened and rendered milder and less dangerous by the quinine treatment, at whatever stage of the disease it is begun, is as clear to me as that it is often aborted by this remedy when given early.

But if the treatment with quinine fail to produce all the results which have been described, it is, so far as careful observation for many years and in a large number of cases enables me to judge, a comparatively *harmless* agent, and all the other means which our art affords can be made available to conduct the case to a favorable termination. It should be added, that in very rare and exceptional cases very large doses of quinine, and even less excessive doses if long continued, affect unfavorably the nervous system, producing delirium and other distressing and even serious results, and should not, therefore, be recklessly given; but such effects are too seldom produced to prevent a resort to this method of treatment as a general practice.

The *salicylate of soda* is very similar in its effects, as an antipyretic, to quinine. It is even more efficient in controlling rheumatic inflammation and fever, and is reported as having been successful in arresting pneumonia. I have no doubt of its tendency to produce that result; but of its effects in pneumonia, as compared with quinine, I

have had, from personal experience, no means of judging. It should be given in larger doses than quinine.

From the discussion of the different remedies for pneumonia which has preceded (carried to a greater length than was at first intended, but not farther than the great interest and importance of the subject seemed to demand), it will readily be seen that if the course of the disease is not arrested, but proceeds through its different stages, no single remedy or course of treatment will be adapted alike to all types, conditions, and stages of the disease. As Jaccoud remarks, there are "pneumonics, but not pneumonias"; that is, there are patients affected with deviations from the normal state in a certain general way, but not with pneumonia as an identical thing, requiring a uniform system of treatment. A variety of remedies are adapted to the different conditions presented, and cases must be individualized and treated according to their several indications. I have endeavored to express my opinion of the various remedies used in the disease, and to point out the conditions to which each is applicable. After a thorough mastery of the principles involved, the judgment of the practitioner must determine the remedies to be selected and the course to be pursued.

I am confident of the propriety of attempting the abortive treatment with the quinine and morphine, or in some of the more advanced stages with the quinine alone, or the quinine aided by some of the other means. When the fever is excessive and the patient not too feeble, the quinine or salicylate of soda, together with the cold pack or cold bath may be used. If the fever be not excessive, fomentations with the silk jacket, or a warm poultice, may be applied to the chest. If there be much congestion dry cups may be applied, hot pediluvia and counter-irritation by mustard plasters may aid. If œdema is threatened, and the strength will allow, a hydragogue cathartic may be given, or jaborandi, or hypodermic injections of pilocarpin might be used. A venesection may be practiced if the patient is plethoric and the congestion is great and not relieved by the quinine or other means, or if the symptoms are too urgent to admit of delay.

When pneumonia persists in its course without those more violent accidents, the danger to life is from interference with the functions of the lungs by the morbid changes and the exhausting and disorganizing effect upon other organs, and especially the heart. When obstruction exists in the lungs, the heart must labor harder to carry on the circulation, and the fever, and the shock especially, weaken that organ. Its power must be conserved, first by controlling the heart—abating its excitement and exhausting efforts—and after by removing as far as possible the obstruction of the lungs, and by sustaining the cardiac action.

The remedies for fulfilling these indications have been sufficiently dwelt upon. The bath, the quinine, and the salicylate of soda are the most effectual means of controlling the heat, and perhaps, also, the intense excitement of the heart. *Veratrum viride* and *aconite* may aid in this work at an early period with comparative safety. When the heart begins to flag it must be sustained. Cardiac stimulants are then indicated—ammonia, moderate doses of quinine, camphor,* musk, hot coffee, and especially alcohol, according to the weight of authority; and the claims of *digitalis*, with moderate doses of quinine (and I venture to suggest *strychnine* also), are to be considered. Exhaustion of the heart—failure of the right ventricle to carry on the circulation through the obstructed lungs—is the greatest danger. Both the obstruction in the lungs and the exhaustion of the heart are best prevented by abatement of the fever. If the fever is kept in abeyance by means not too depressing, the inflammatory changes are checked and the local disease usually subsides, and the heart is kept from exhaustion. In a superabundance of blood the heart must labor harder, and if that superabundance really exists, it may, with the utmost propriety, be reduced. There is hazard in a great loss of blood, as the heart may be weakened by it more than it is relieved by the diminution of its work. A bleeding is safe only in vigorous subjects, and must always be used with the greatest caution and discrimination. It may be followed by cardiac stimulants.

The bath or pack is an effectual means for controlling the heat, and is an excellent palliative measure, but it has not the abortive effect of quinine. If the heart is kept in action, in time the inflammation will abate. Nourishing food, regularly given, is essential. A neglect of this may of itself be fatal. Milk, beef-tea, farinaceous preparations thoroughly cooked, egg-soup, etc., are the chief articles. In the later stages, or when diffused suppuration, abscess, gangrene, or other disorganizing changes in the lungs occur, tonics, quinine, iron, *strychnine*, and other supporting measures will be required. In some protracted and low cases the oil of turpentine is often very useful. It may be given in emulsion, with or without additions, or twelve or fourteen drops once in four hours, in milk. When the exudates are not readily removed, besides treatment for keeping up the tone of the system, sorbefacients and eliminatives, such as iodide of potassium, hydrochlorate of ammonia, and acetate of potash, will be

* R Gum Camphor..... ʒij
Mucilage or Water..... ʒvjss

M.—Emulsion. Dose: A table-spoonful once in two hours, or oftener. (Jurgensen.)

required. I regard the usefulness of these latter agents as unquestionable.

The treatment of pneumonia may require to be modified as the disease occurs in different localities and seasons, in the city or country, in hospital or private practice, among well or ill-to-do people, and as it assumes different types under different epidemic influences. When it occurs in malarious regions quinine is doubly necessary. The secretions are often so perverted that mercurials and cathartics are necessary. A few grains of the blue mass early in the disease will generally be of material service and render the other remedies more efficient.

In many cases of moderate severity, where the disease is confined to a single lobe, where the fever is not excessive, and the previous health and vigor of the patient were good, no treatment may be required; and yet it is impossible to determine whether in a case more favorable at the commencement, the disease will not extend, and the case become worse. Abortive treatment, therefore, if harmless, should not be neglected.

The treatment of an ordinary case of acute pneumonia may be briefly summarized as follows:

When seen in the beginning, an effort should be made to arrest the disease and prevent its full development by either free doses of quinine, free doses of opiates, or, better still, the free use of these remedies combined. If the fever does not return, the local congestion and beginning exudation will soon disappear; but if they linger, and as a rule, it is best to use an eliminative cathartic after the full impression of the quinine and opiate has been made, and this should be followed by some gentle saline eliminatives, as iodide of potassium, hydrochlorate of ammonia, acetate of ammonia, or acetate of potash.

Should the fever return, after the proper evacuations, the free doses of quinine or the quinine and morphine *should be repeated*.

If the disease in an active form still persists (which according to my experience is very unusual), the bath or pack, aided by quinine or salicylate of soda, will be proper.

If the use of the cold be objected to, if the means be not at hand to properly carry it out, or it be thought not safe, the antipyretic medicines may be given without the cold; and the other measures so fully discussed may be brought into requisition as the symptoms may indicate and the judgment of the physician approve.

If the case is seen later in the stage of hepatization, the quinine should still be given. It will act as an antipyretic and tend to diminish the inflammatory process, if it does not arrest it; and with the other means described will aid in conducting the patient through.

If this abortive treatment accomplishes what is claimed for it (and

that claim does not now rest upon the testimony of a few), an advance has been made in the treatment of inflammations in general, and particularly of pneumonia, second in importance to none that has occurred in practical medicine in modern times.

In consequence of the great importance of this subject, of its relations to all other forms of fever and inflammation, of its being the special battle-ground of differing therapeutical views, I have endeavored, at greater length than would have been most agreeable, to express the leading views of the present day, as well as those which my own investigations and experience have enabled me to form.

No one can feel more keenly than he who attempts the task, how imperfect is the account of the treatment of a disease that has so many varying elements as pneumonia. As was recently said by one describing the treatment of another disease: "Were I the wisest of therapeutists, and had I the best rhetoric, my description would still be imperfect. The variations of health and constitution, of complications and other conditions are so numerous, that a perfect theory or system of treatment would not carry with it directions for every individual case. Boundless scope after all would be left for the intelligent interference of the practitioner."

Acute lobar pneumonia, with the anatomical characteristics described, sometimes, though more rarely, occurs in children. With them it is a much more grave disease even than with adults, and it very often proves fatal. The subjective symptoms are much less marked, and the physical examination is effected with more difficulty; thus the diagnosis is less easy, and the disease is not unfrequently overlooked. The attack is sometimes, as in other severe diseases in children, ushered in by a convulsion, followed by drowsiness and stupor, and the attention may be directed to the head rather than the chest. Indeed, the local symptoms may be latent, as is sometimes the case with adults, and often in the aged. There is sometimes pain, especially on coughing or taking a full breath, and there is generally a groaning or grunting sound with each expiration. The respirations are exceedingly frequent in severe cases before an asphyxiated condition occurs, the pulse is rapid—from 150 to 200; the breath remaining so short a time in the chest is apt to be cold, and the course of the disease is often rapid.

The differential diagnosis will be between this and pleuritis, bronchopneumonia, and capillary bronchitis. A careful physical examination and an observance of all the rational symptoms will be necessary to make the distinction. The crepitant râle is often absent, but the bronchial respiration and bronchophony will be present, and

all the signs will be unilateral, as a rule, while those of capillary bronchitis and bronchopneumonia will be bilateral. The physical signs will be essentially the same as those which occur in the adult, and need not be detailed.

The same principles of *treatment* will apply as with adults, modified, however, by the infantile condition. Young children do not bear blood-letting, antimony, and other depressing agents as well as adults; but they bear quinine quite as well, and opium may not be entirely withheld; it should, however, in all its forms, be given with great caution as to the size of the dose. There is danger of blisters becoming inflamed and even sloughing, but milder forms of counter-irritation may be applied, and poultices or water dressings, or, as a substitute, the spongiopilin may be placed over the chest with advantage. Some strongly recommend the simple cold pack, but I cannot speak from experience of its use with young children. Supporting measures with children, as with adults, may be required in the latter stages of disease, and, in short, the same remedies essentially are appropriate.

LOBULAR PNEUMONIA.—CATARRHAL PNEUMONIA.—BRONCHOPNEUMONIA.

By these terms is meant an inflammation involving the bronchi, particularly the smaller branches, the bronchioles, and the alveoli, and often extending more or less to the intervesicular structure of certain lobules. The inflammation is of a different type from that of fibrinous or croupous pneumonia which we have been considering; the fever accompanying it is supposed to be less essential and specific in character, and the exudate is catarrhal and mucous, or cellular, rather than croupous and fibrinous. It may be either acute or chronic, but it is chiefly and typically acute.

Its causes, when idiopathic, are essentially the same as those of acute bronchitis, and the disease frequently commences in the upper bronchial tubes, and even in the upper air passages, extending secondarily to the alveoli, as has been described when treating of bronchitis. The disease is very often secondary to measles and other eruptive fevers, and to whooping-cough. It may also be secondary to atelectasis—inflammation occurring in the collapsed lobules. It may also be secondary to an ordinary acute bronchitis, the inflammation in the alveoli being excited by the gravitation into them of a bronchial secretion containing irritating properties. It occurs in old people oftener than in adults, and the extremes of life are predisposing causes. It is not unfrequently excited by the inhalation of irritating

vapors, or of dust. It is said to be frequent among workmen engaged in "grain elevators," who inhale for long periods the dust from the grain they shovel about in bulk. Coal-heavers are also subject to it, but they are more frequently affected with a chronic inflammation and wasting, called miner's consumption.

Symptoms.—Symptoms, such as have already been described as belonging to bronchitis of the smaller tubes, supervene; and when the inflammation reaches the lobules, the temperature rises to a maximum of 104° or 105° , and is marked by only slight morning remissions. It affects different lobules scattered throughout the organs, but a sufficient number of them, together with the inflammation of the small bronchi, to produce the greatest amount of dyspnoea in severe cases, and to constitute a very grave affection.

As lobular pneumonia is accompanied by bronchitis, which is bilateral, this almost constantly affects both lungs, but is usually more intense in the lower portion. There will be cough, at first ringing like that of early bronchitis; later it will be more stuffy and restrained, as its occurrence gives pain. The severity of the dyspnoea will depend upon the number of lobules involved, and the amount of inflammation and exudation in the small bronchial tubes.

The fever will vary according to the acuteness of the inflammation, but it is higher than in simple bronchitis. The symptoms are apt to fluctuate as the disease extends or recedes, as accumulations in the tubes increase or diminish, and as different lobules become collapsed or admit the air. The inflammation often extends from the lobules to the pleura, causing pain and stitch on motion, and coughing. The expectoration is usually abundant, and is not as tenacious or bloody as in croupous pneumonia; but from failure of the strength of the patient, or the unusual tenacity of the exudate, it may cease to be raised; when, if the secretion continues, suffocating symptoms and carbonic-acid poisoning soon supervene.

There is a combination of the symptoms belonging to bronchitis with those of pneumonia, and as each class of these phenomena has been so largely dwelt upon, they need not be farther detailed.

Morbid Anatomy.—The structural changes involve the bronchial tubes, the alveoli, and often the connective tissue and the pleura. The mucous membrane undergoes the changes described in the article on bronchitis, to which reference is made. Something was then said of the manner of extension of the disease from one tissue to another. The changes in the lung tissue have been divided into the same three stages as in lobar pneumonia, viz.: Inflammatory engorgement, red hepatization, and gray hepatization. These distinctions, however, are less marked by peculiar symptoms or anatomical appearances than those of

lobar pneumonia, and are therefore less important. In a typical case, small firm spots, varying in size from a pea to a pigeon's egg, and sometimes larger, are disseminated throughout both lungs. The color varies. It may be brownish red, reddish gray, more gray, or yellowish, and the periphery is usually darker than the centre. The inflamed spots as the chest is opened collapse less than those parts that escape, and the surface of the lung is therefore covered with irregular elevations, and presents a mottled appearance; and the pleura covering the inflamed lobules is likely to have a thin layer of fibrine upon it. According to the amount of exudate in the vesicles of the inflamed lobules they will sink or swim in water, and will crepitate or not on pressure. From the cut surface will usually exude a cellular semi-fluid material, and especially from bronchi cut across a muco-purulent substance will commonly ooze out, especially on pressure. Under the microscope the alveoli are seen filled with cellular and granular exudates, but not of as firm a consistence, nor are the cells as much distended, as in croupous pneumonia; and the fibrine, so abundant in the latter, is absent or much less in quantity in the catarrhal. In some cases this material has doubtless been drawn into the air-cells from the bronchi, but in others the cells have probably been produced from the epithelium of the air vesicles, and doubtless leucocytes from the blood contribute to its production. Some red corpuscles are usually present, but not so many as in croupous cases. There are, however, gradations from the more catarrhal to the more croupous form of exudate.

The cut surface does not present as granular an appearance as in croupous pneumonia, and the exudation is found, to some extent, in the intercellular passages as well as in the alveoli. As in croupous pneumonia, the hyperæmia at first is great and the color is a deep red; but as the exudates are poured out the blood is pressed out of the vessels, and the color becomes more grayish or yellowish. The exudate often undergoes fatty and purulent metamorphoses, and pus is found not only in the bronchi and alveoli, but sometimes in the inter-vesicular tissue. The structure is sometimes broken down, and minute abscesses are formed. These may enlarge and coalesce, cheesy degenerations may take place, and thus a form of phthisis originates. Before the exudates are produced in the alveoli, the obstruction of a bronchus, if it occur, will lead to collapse of a lobule connected with it, and these collapsed lobules are often found. Persistent congestion and the development of inflammation is the usual result of a collapsed condition of a portion of lung from whatever cause. As compensatory, other lobules often become emphysematous, and thus a mottled appearance is presented.

The inflamed lobules generally occupy the periphery of the lungs, and appear upon the surface as the chest is opened. They are sometimes few and scattered, but in other cases they are more numerous, and in considerable patches confluent.

In favorable cases these exudates, as the inflammation is resolved, undergo a form of fatty degeneration, are emulsified by a serous fluid which is exuded, and are rendered capable of absorption. Some of the material is expectorated, but most of it is absorbed away and is disposed of by these methods.

Diagnosis.—This depends, as in other pulmonary affections, upon the rational symptoms and physical signs. The first have, perhaps, been sufficiently indicated. The physical signs depend upon the bronchitis and upon the inflamed, collapsed, and emphysematous lobules. On inspection, statically and dynamically, the two sides are alike, as the disease is bilateral. On percussion, in severe cases there will usually be some dulness; but as it occurs on both sides about alike, there is not the advantage of contrast, and this sign will be comparatively negative. Sometimes, however, a sufficient number of lobules are inflamed in an aggregate mass to afford evidences of consolidation in limited spaces, and dulness on percussion may be marked as compared with other points in which, from emphysematous dilatation, there may be evident sonorousness. The comparatively negative character of the percussion will tend, however, to exclude lobar pneumonia and pleuritic effusion. On auscultation, the bronchitis will present the usual signs of râles, usually bubbling finer and coarser, according to the size of the tubes in which they are heard; and the fine and the coarse are generally mingled together. Bronchovesicular and bronchial respiration will sometimes be heard, mingled with subcrepitant or fine moist râles. In some cases where consolidation is not apparent, it is difficult from the physical signs to differentiate bronchopneumonia from capillary bronchitis; but it is not essential to do so, as neither the prognosis nor the treatment will greatly differ. By these evidences it is to be distinguished from bronchitis, cronpons pneumonia, acute tuberculosis, and cedema of the lungs, which diseases it resembles in some features.

Prognosis.—This in bronchopneumonia is grave. It is stated that taking all the cases into the account, in the young and old, about one half die. It may be a question whether the statistics of former times, when showing a mortality in pneumonia of forty and sixty per cent., did not include many cases of bronchopneumonia and capillary bronchitis. Of the recoveries some are comparatively speedy and complete, others are slow and imperfect, portions of lung remain-

ing contracted and others emphysematous, while in others cheesy or fibroid degenerations occur, and phthisis, as already stated, finally results. In the fatal cases, death usually occurs in from a very few days to a week or a little over; but recovery, after the disease is fully developed, can scarcely take place in less than two or three weeks. In the rapid cases the mode of death is by apnœa—carbonic-acid poisoning, coma, etc.—as in capillary bronchitis.

The chief danger in bronchopneumonia is from the obstruction of the bronchi by their swelling and the accumulation of the exudate within them; though the filling up of small lobules and the collapse of others, together with the shock of so extensive disease, and the influence of the fever, will contribute to the production of the serious results. These dangers are very great, and if there are any remedies which afford even a remote prospect of arresting a disease which proves fatal in one half the cases, they should be promptly and energetically used.

Treatment.—In my judgment there should be no delay in bringing the system at the earliest stage possible under the full influence of quinine and morphine, keeping up the effect for several hours, holding the fever in abeyance, and checking, as this combination is capable of doing, the inflammatory action. The paralyzing statement that internal inflammations cannot be arrested should be given to the winds. In the individual case such arrest may or may not be effected. At least the severity may be diminished, and the effort should be made. When the disease occurs in children, as it oftenest does, the morphine should be cautiously given and its effects carefully watched; but it aids the abortive antiphlogistic effect of the quinine, and unless the obstruction to respiration is great, it should not be entirely withheld. The danger in the later stages of its contributing to the apnœa exists, but it has perhaps been exaggerated. I have in two well-remembered cases witnessed a decided accidental narcotism in the latter stages of very severe pneumonia followed by marked improvement, instead of the fatal result which was expected. However, opiates should be used with great caution, especially with children, and in advanced stages with much obstruction of respiration they should be omitted.

The details of treatment are almost identical with those for capillary bronchitis, and need not be repeated. The reader is referred to the article on that subject. The salts of ammonia—the carbonate, iodide, and muriate—are often particularly useful in rendering the sputa less tenacious, and the carbonate especially in keeping up the heart's action, which is in such danger of flagging. The following is a specimen prescription:

R Carb. Ammonia	ʒij
Iodide of Ammonia.....	ʒj
Mucil. Acacia,	
Simple Syrup	āā ʒj
M.—Dose ʒj to ʒiij once in from two to four hours.	

Other stimulants are often required. In children, especially, emetics are not unfrequently demanded for removing bronchial accumulations, and those least depressing should be selected. The hypodermic use of apomorphia is thought to be preferable. Nareotic effects from this article have occasionally been produced, supposed to be due to the presence in it of morphia. Such effects are dependent upon some other substance than the pure apomorphia, some impurity of the article sometimes arising from a change in its composition which it is apt to undergo by standing in solution. Emetics often require to be repeated from time to time, and if operating favorably, they relieve the dyspnœa without too much depression, and diminish the cyanosis. The sulph. of mercury is advised by some, and lobelia together with some hot stimulating vegetable tea has its advocates.

The inhalation of steam, or an atmosphere kept moist by it, and various other inhalations by the atomizer, as solutions of chlorate of potash, muriate of ammonia, or common salt, may be of use. Inhalation of the oil of turpentine, effected by dropping a small quantity upon hot water, will often produce relief. The inhalations of an atmosphere made rich by the addition of oxygen gas will relieve the cyanosis, and, repeated from time to time, may bridge over the chasm and keep the patient alive until a favorable local change occurs.

Full, forced inspirations, from time to time, tend to prevent atelectasis, and Juergensen advises that these should be promoted by cold affusions or a douche directed upon the nucha. The decubitus should be changed, as this tends to prevent hypostatic congestion.

The conditions of *hypostatic congestion* and *hypostatic pneumonia* have been referred to in connection with the description of fevers in which they are most likely to occur. Secondary in occurrence, and passive in character, they indicate the use of supporting measures, and the treatment of the original affection will of course require attention. Full inspirations, from time to time, and a frequent change of position in bed, will tend to prevent these conditions.

BROWN INDURATION OF THE LUNGS.

A pigmentary induration of the lung tissue produced by long-con-

tinued passive hyperæmia, the result of obstructive disease of the left side of the heart, particularly stenosis of the left auriculo-ventricular opening or insufficiency of the mitral valves, has been referred to, but requires a farther though brief mention.

The *symptoms* connected with this state are not definite, and may not be distinguishable from simple congestion or œdematous effusion caused by the obstructed circulation. Dyspnœa, however, will be increased by this state, and will be more constant; and when the effusion is sufficiently extensive, there will be dulness on percussion and bronchial respiration.

Its *pathological anatomy* is better known than its clinical history. Lungs thus affected do not fully collapse when the chest is opened. They are of a fleshy or leathery consistence; they are inelastic, dry, and heavy; crepitate but slightly on pressure, and have a dark reddish-brown, or brownish-yellow, or sometimes a salmon color upon the surface; and on section brown or ecchymosed spots are found scattered through the tissue. On microscopical inspection dilatation of the pulmonary capillaries is discovered, loops of which frequently project into the alveoli, more or less diminishing their capacity; and large epithelial cells, containing brown or yellowish-brown pigment, are sometimes in the air vesicles in sufficient amount to fill them. Pigment is also found within the capillary vessels, in their walls, and in the interstitial tissue, sometimes free and sometimes inclosed in capsules. This coloring matter is derived from the red corpuscles; which have passed into or through the walls of the minute vessels by diapedesis or by their rupture. Hyperplasia of the cell walls and the interstitial and parenchymatous tissue is often found.

The treatment, when this condition is suspected, must be directed chiefly to the obstructed circulation through the heart, though the muriate of ammonia or the iodide of potassium may tend to diminish the morbid hyperplasia.

PNEUMONOKONIOSIS.

Under this general name, recently proposed, are included conditions produced by the inhalation and lodgment in the lungs of various dust-like substances. A diseased condition of the lungs from coal dust—the miner's consumption—has long been recognized. This has received the name of anthracosis. The manner of the introduction and accumulation of this material, and its effects in the lungs, have been alluded to. The particles of coal dust floating in the inspired air pass into the bronchi and air vesicles, and make their way

through the air vesicles and minute bronchi into the alveolar and lobular septa and the lymph spaces and lymph vessels, especially around arteries, into the peribronchial and intervesicular connective tissue, and into the deeper layer of the pleura; and some are further distributed into the bronchial glands, and occasionally into more distant lymphatic glands through lymphatic vessels. When a sufficient amount of accumulation takes place, blood and lymph vessels are obstructed, slow inflammatory processes are set up in the bronchi and the interstitial connective tissue, dense fibrous bands and deeply pigmented nodules are formed, the walls of the alveoli are thickened and their lumen may be obliterated, the bronchi in places may be dilated, and, finally, ulcerative cavities of various sizes may be produced, and coal-miner's phthisis is the result. Tubercular deposits may or may not take place, mingling with the foreign matter and inflammatory products, and destructive changes go on as in other cases of phthisis, while more or less of black material will appear in the expectoration.

Other forms of dust may be inhaled and accumulate, producing similar results. The oxide of iron in certain workmen produces what has been called *siderosis pulmonum*, and the term *chalicosis pulmonum* has been applied to a similar disease produced by inhalation of stone dust—stone-cutter's consumption. Steel grinders, millers, workers in cotton and tobacco manufactories, etc., may be affected in a similar manner.

In all these cases symptoms of bronchopneumonia, sometimes acute, but generally chronic and obstinate, appear, often going on to destructive changes.

The first requisite of Treatment is to remove the patient from his perilous occupation. Symptomatic treatment will then be demanded, such as is applicable to chronic bronchitis, pneumonitis, and phthisis.

INTERLOBULAR PNEUMONIA.—INTERSTITIAL PNEUMONIA.

This is an inflammation of the intervesicular connective tissue of the lungs.

In an acute form and as a primary affection this is a disease of extreme rarity in the human subject. It has, however, been described by several authors, among whom are Carswell, Hodgkin, Stokes, and Rokitansky. I have seen a very few cases that I believed to be of that character, but the opinion was not verified by post-mortem examinations. In one case a gentleman about forty-five was attacked with a chill, fever, pain in one side of the chest, a cough,

dyspnœa, and other symptoms indicative of pneumonia. I saw him in consultation when the disease had continued about ten days. There had been no expectoration from the beginning, and there was none of any amount throughout the disease. There had been and was no distinct pneumonic crepitation; there was less motion of the affected side; a degree of dulness on percussion, but not as much as in hepatization, where the air vesicles are filled with exudate; neither was the respiration sound as bronchial as in hepatization; and a feeble respiratory murmur was heard. There was no evidence of pleuritic effusion, and the diminished motion and dulness were too great for dry pleurisy. The case lingered for a few weeks, assuming a subacute form; improvement gradually took place, and a fair state of health was for a time regained, but the lung never completely recovered, and some two years later symptoms of phthisis were reported to have come on, and death in some months occurred. I cannot say that there were no tubercular deposits preceding this attack, but there were no evidences of them. The inflammation occurred in the lower and middle, and not in the upper part of the lung where tubercles are usually first deposited; it was acute in its onset but lingering in its course, and I still believe was primary and interstitial. I have seen a few other cases of similar attacks where recovery was slow, but apparently complete, and where tuberculous disease did not occur afterward. As all the cases I have seen have survived these attacks, there have been no opportunities for anatomical demonstrations. Dr. J. D. Lincoln and Prof. A. Mitchell, of Brunswick, Maine, called my attention to cases in their experience (one of which I had an opportunity of examining) that were believed to be of this character. There was an absence of expectoration in all of the cases, and they lingered longer than ordinary cases of pneumonia, but without severe symptoms. The implication of the interlobular spaces in acute cases, thought to be so rare in man, is said to be the ordinary condition in the acute pleuropneumonia of the bovine species, as described by Prof. Weber, of Kiel.

Secondary and chronic forms of interstitial pneumonia are much more common. Implication of the connective tissue of the lungs in inflammation may (1.) follow and complicate croupous and catarrhal pneumonia. (2.) Such inflammation may be produced by collapse of the lungs. (3.) It may be excited by tubercle, cancer, and hemorrhagic infarction; and in abscess there is exudation in this tissue more or less organized. (4.) It is frequent in chronic bronchitis, as has been shown, playing an important part in the contractions and dilatations which occur in bronchiectasis. (5.) It may occur in a chronic form as a primary affection, though more frequently second-

ary, and may be the result of various causes, most frequent among which is the free use of alcohol.

In all these cases there is hyperplasia of the connective tissue, carnification is produced, bands of fibroid structure are present, small *gray* and larger *yellow* nodules are formed, and pulmonary cirrhosis, more or less distinctly marked, often results. In this condition of the lungs pulmonary hemorrhage sometimes occurs, a chronic cough becomes troublesome, and cheesy degeneration of the morbid structure, or tuberculous infiltration, and final breaking down may follow.

Interstitial pneumonia, when arising from brouchitis, is commonly bilateral, the volume of the chest becomes diminished from the contraction of the lung tissue, and there is flattening under the clavicles. While the lung is shrunk in parts, compensatory emphysema occurs in others. The pleura is generally thickened, and sometimes almost cartilaginous in appearance in places. The fibrous bands run toward the pleura and are often pigmented, bronchiectatic cavities are formed, the bronchial mucous membrane is congested and thickened, and exudes a purulent-looking catarrhal fluid. Morbid cellulation takes place in the connective tissue, and a contracting cicatricial tissue is the result. Degenerative changes (caseation) often take place. The small, gray, gelatinous, or cartilage-like nodules Hamilton pronounces *tubercles*; while the larger yellow masses are cheesy substances, the result of the caseous metamorphosis of other substances. A form of phthisis then results, and the symptoms and course of these cases are best considered in connection with that general subject.

The *Treatment* of the acute cases will not differ materially from that which is applicable in other forms of pneumonia with similar general symptoms. An early impression may be made with quinine and morphine, and this may be followed by salines, diaphoretics, perhaps small doses of antimony, etc.; but as the disease approaches the subacute or chronic form, I know of no remedy so likely to influence the cases favorably as iodide of potassium. It should be given in free doses and be persevered with, and anodyne or various other medicines may be combined with it as particular symptoms require.

The symptomatology, diagnosis, prognosis, and treatment of the chronic cases pertain to the subject of phthisis, and will be described hereafter.

There are various particular anatomical forms of chronic pneumonia which may be named here. We may have (1.) a uniform albuminous induration, terminating in abscess. (2.) A similar condition terminating in gray induration. This may soften afterward, becom-

ing consumption or wasting by abscess. (3.) A similar state, terminating in granular induration, which may undergo cheesy degeneration or produce yellow tubercle. (4.) A chronic tuberculous pneumonia, genuine tubercle being present, the inflammatory action resulting in the production of tubercle. (5.) Inflammation accompanying chronic phthisis or wasting, the tuberculous formation being perhaps primary, with degeneration and breaking down following, with deposits in and ulceration of mucous surfaces, as in the larynx, trachea, bronchi, and intestines. These forms all belong to the subject of phthisis.

PHTHISIS PULMONALIS.—PULMONARY CONSUMPTION.—TUBERCULAR PHTHISIS.—PULMONARY CASEATION.—PULMONARY CIRRHOSIS.—TUBERCULOSIS.—LARYNGEAL AND PULMONARY PHTHISIS.—CONSUMPTION.

General Remarks.—Whatever views may be entertained as to the essential unity or plurality of the disease generally treated of as consumption, there are several particular pathological states or varieties of phenomena, resulting in wasting of the lungs and of the general system, which are indicated by the terms at the head of this article. The pathology of no disease has been more discussed than that of phthisis. That discussion has extended through a long period of the past, and, with scarcely any abatement, has continued to the present time. Some of the controversy has been about the use of terms, and much of the discussion respecting the facts of the disease would have been avoided had the fundamental truth more constantly been borne in mind, that *disease is but changed physiological action*, that all structural disease is but perverted nutrition, that there are many varieties of such change and perversion, shading off into each other, and that certain names are given to such groups of changes as present phenomena having certain resemblances, but without absolute and fixed identity. The pathological changes in some diseases, it is true, are comparatively uniform and peculiar in their leading characteristics, and these diseases have a clearly distinguishable individuality, while others are more variable and indefinite, rendering distinctive naming difficult or impossible. With a vague impression that a disease called by a particular name—phthisis or consumption—must be essentially an identical condition, it is not surprising that great differences of opinion should exist among those who look at the affection from different stand-points, and who are more familiar with some than with other of the phenomena. The fact cannot be too strongly impressed, that a variety of changes of nutrition,

resulting in destruction of lung tissue and in wasting disease, are grouped together under the name of phthisis or consumption, and that uniformity in the pathological characteristics of all cases does not exist.

It is probable that all *specific* diseases which are uniform in essential character, such as small-pox, scarlatina, typhoid, typhus, relapsing and malarious fevers, are caused by specific poisons, giving thus to each disease, at least in origin, a common character. But even those produced by the same poison have their variations in accessory influences, in phenomena and results. In consumption, however, though the ultimate results are much the same, yet different cases have various origins and characters, and there is no one specific poison which is a cause of all. It is, to be sure, thought by some that a specific germ capable of transmission is the cause of genuine tubercular phthisis, and this may possibly be the case in some instances, though it has not been positively proven, and the probabilities in the great mass of cases are vastly against the assumption.

Consumption is doubtless often hereditary, but there is no proof that a specific poison is communicated from the parents to the offspring, at least in the ordinary cases where the disease is not manifest at birth or for many years afterward. There is only a disposition to take on these morbid actions from an inherited impulse.

There is a general agreement among pathologists that in consumption in all its forms there is a lowered and perverted state of vitality, resulting in nutritive changes in the lungs, in the production of a *degraded bioplasm* which is deposited or developed in the lungs, and from its degradation this bioplasm tends to lose its vitality and sooner or later to break down, involving destruction of the lung tissue, causing wasting of the general system, and, in most cases, the death of the patient.

These points are not in controversy. The differences are as to the nature of the changes, as to their essential unity or plurality, and especially as to the origin, character, and relations of tubercle; whether it is a specific neoplasm like cancer, or a non-specific product of inflammation; whether it is primary and essential, or secondary and accidental; and whether any disease should be called consumption where tubercle is absent. Indeed, there is not uniformity of opinion as to what should be called tubercle; and these various questions involve others no less interesting, and even more practical, such as its constant hereditary character, its communicability by inoculation or contagion, the changes the tubercular matter undergoes, and the pathological forms it takes.

Pathological Character.—Two leading views have long been,

and still are, struggling for the mastery. The first distinctive views since pathology has been studied scientifically—since morbid materials were named from their composition and minute structure rather than from their external massive appearance, and since tubercle meant more than a nodule or projection—were held by Stark, of London, who in 1775 recognized miliary tubercle, or small, gray, semi-transparent bodies, the size and shape of millet seed. Reid, about the same time, made a distinction between tubercle and scrofulous enlargement of the glands. Not long after, Dr. Baillie taught the formation of larger tuberculous masses from the confluence of miliary tubercles in the lungs, and spoke of infiltrated granular substances, or as it had been called, “scrofulous matter,” as identical with the material of tubercle, which material was named by Portal, of France, tuberculous matter. Baillie described tubercle of other organs than the lungs—of the liver, spleen, kidneys, and cerebral membranes.

In 1810 small masses were first discovered in the larynx and trachea, and were called by Bayle, of Paris, the immediate predecessor of Laennec, miliary tubercles; and he described consumption as not a local disease of the lungs alone, but as a general disease of a peculiar character, and not a mere inflammation of special tissues. He established in the minds of pathologists the idea of the “tubercular diathesis.” The cheesy change, which has been so much noticed of late, he regarded as evidence of tuberculous degeneration; and by his teaching the word tubercle lost the meaning of nodule and took that of tuberculous matter. This tuberculous matter in its primary form, or as miliary granulation, was described as being transparent, shining, of an appearance like cartilage, and as having much persistence in that form. Bayle denied that consumption ever originated in inflammation of the lungs, pleura, or bronchi.

Laennec succeeded Bayle, adopted many of his views, added others, formed a more comprehensive system of tubercular pathology, and by his high authority, which to a large extent was due to his discoveries in physical diagnosis, and by his observations and teachings of forty years, from 1786 to 1826, so impressed his views as to cause most of them to be generally accepted until within a few years past. They were, however, more or less modified from time to time by new discoveries and the teachings of others, but were substantially accepted until the German pathologists questioned and rejected the most essential of them, and impressed their views on many of the profession. Very recently, however, there has been a reaction from the German doctrines, and, in France particularly, the doctrines of Laennec, with some modifications and additions made by modern investigations, aided by the microscope, are being strenuously contended for.

Laennec taught that tuberculous granulations were the first stage of miliary tubercles, and that the latter were transformed into a crude yellow material, and the term tuberculous matter was applied throughout the whole of the stages and to all of the forms of these matters. It was alike applied to the transparent, gray, yellow, or cheesy deposits occurring in the lungs or elsewhere. The inference was that if yellow cheesy matter was found in the lungs, it had been gray—had been granular and miliary, and would soften and pass into ulceration if life continued. Thus Laennec called all cheesy matter tuberculous, regarding it as originating in gray tubercle, and he declared that phthisis always depended on tubercle. In his view, phthisis and tuberculosis were identical. Scrofula was tuberculous disease appearing in the glands. Although Laennec's views have obtained such extensive acceptance, they were combated by his contemporary Broussais, who made *irritation* the great central fact in pathology, and regarded tubercle or tuberculous matter as simply the product of inflammation. Both made phthisis depend upon tubercle, but Laennec regarded it as a neoplasm, and Broussais as an inflammatory product.

Andral regarded crude yellow tubercle as primary, as first liquid, and afterward becoming thickened. He thought it a secretion or deposit from the blood, allied to pus, and said that inspissated pus became what was acknowledged as tubercle. He ignored the doctrine of the change of gray into yellow tubercle; and held that inflammation and hæmoptysis were the most frequent causes of consumption.

Louis, on the other hand, supported Laennec, and their views became established in France.

The Germans and English had their views, but individual pathologists differed; and now the microscope came into use, but without settling all the questions it placed the controversy upon a new basis, and a particular form of cells was regarded as the criterion of tubercle.

But the cells of what was thought to be tubercle were found to vary, and however distinctive their character, the question of origin was not determined.

Lebert, whose last work was on phthisis, and was one of the most striking evidences of his industry and genius, in his earlier writings denied the inflammatory origin of tubercle, but after longer observation and experiment admitted it.

Reinhart, Green, and a host of others contended for the inflammatory origin of this material, declaring, if not proving, that what are called tubercle corpuscles may be formed from pus cells.

Virehow took a position between these extremes, and in my judg-

ment nearer the truth than either. He quite satisfactorily showed that what was called "cheesy" matter was in some cases at least only thickened pus, mingled often with other inflammatory products, but without any specific or invariable qualities; that such material found in the midst of cancer growths was degenerated cancer tissue; and he taught with his usual zeal and force that crude tubercular matter in the lungs of consumptives was often the result of the inflammatory process.

But he did not therefore contend that all tubercle was the product of inflammation. He admitted that gray tubercle might, and often did, appear without the full inflammatory process, and that gray tubercle, as a low organization, might undergo the cheesy degeneration.

He taught, what I do not doubt is the truth, that various pathological products, such as tubercle, cancer, pus, and other inflammatory exudates, may undergo this cheesy change, and that this is one of the forms of retrograde metamorphosis.

The tendency to take exclusive views, to contend that a single cause produces a result, when that result may follow different causes, often leads to error in medicine as in other subjects. The inflammatory process is not so abruptly limited and so specific in its character that we are always able to speak positively of its existence or non-existence in particular cases. It shades off into irritation and other morbid processes, into neoplastic growths, simple congestions, hypertrophies, and even increased physiological actions, so that its boundaries cannot always be defined. The gray material, as a specific pathological product to which many propose that the term tubercle shall be restricted, is a result of a perverted nutritive process, but whether that process should be called inflammatory depends upon the limitations given to inflammation. Hyperæmia, exudations, and cell proliferations occur in inflammation; they also occur in other processes not usually called inflammatory, but their naming is only a question of the use of terms.

That the occurrence of inflammation in the bronchi and lung tissue favors the production of genuine or gray tubercle and of cheesy products, formerly, and still by many, called yellow tubercle, I have no manner of doubt. That the production and changes of these materials constitute phthisis, should not be questioned; but as to whether there is *always* present a specific material with definite structure, with the "giant cells" now regarded as characteristic of true tubercle, there are differences of opinion. That such material is usually sooner or later present, modern investigation proves; that such production is sometimes primary and non-inflammatory, there is reason to believe; but that it is usually associated with distinct inflammatory processes

even early, and nearly if not always later in the progressive cases, is unquestionable. If this view of the subject be the true one, neither of the exclusive doctrines dividing the profession on this subject can be very long sustained.

The doctrine of Laennec, which admits but a single variety of phthisis, and makes all depend upon a morbid product unique in all its characters—upon specific tubercle allied to otherspecific neoplasms,—and his doctrine of the unity of consumption, though at present in great favor in the French school, seem to me not established.

The other doctrine recognizes two varieties of consumption—one corresponding to the single variety of Laennec—tuberculous phthisis properly so called; the other has nothing in common with tubercle, and arises from a special pneumonia called caseous pneumonia, but which also results in ulceration and wasting.

The author of the very elaborate article in the French New Dictionary of Medicine and Surgery advocates the exclusive view of Laennec, and he is sustained by Thaon, Charcot, and others. They teach that tubercle is not a lesion of an inflammatory nature, but is a neoplasm as distinct in its character as sarcoma, carcinoma, etc., and is generalized in the system by the circulation.

That genuine tubercle is quite definite in character and is a neoplasm, cannot be successfully denied; but that it is always present and the only pathological cause of the disease we call phthisis, cannot be proved, or at least has not as yet been substantiated. Neither has it been shown that consumption with genuine tubercles cannot be produced by inflammation under unfavorable hygienic circumstances. Indeed, a long-continued irritation or inflammation may act as a cause in the development of cancer or other neoplasms, and may undoubtedly also be a cause of tubercle.

On the other hand, it has not been shown that in the second variety of phthisis, as recognized by the dual theory, there is nothing in common with tubercle. On the contrary, it is found that true tubercular elements—small nodules of gray color and gelatinous or cartilage-like aspect, with the characteristic “giant cells”—are present in the immediate neighborhood or mingled with the caseous matter, in cases commencing in inflammation (in bronchitis and pneumonia), and resulting in the formation of exudates which go on to cheesy degeneration.*

* Virchow, in the discussion on tubercle which occurred at the meeting of the International Congress in London, in 1881, said he regarded tubercle as a *neoplasm*, but that he made no necessary distinction between a neoplasm and an inflammatory product. He defined a neoplasm “a new formation, which has arrived at a certain degree of independency.” It may be inflammatory at first, becoming more

D. J. Hamilton, of the University of Edinburgh, says this tubercular structure is one of the best marked of all the neoplasms, and can be recognized as tubercle in two or three weeks after it has commenced to grow. "It consists of a markedly rounded growth, quite distinguishable by its peculiar structure from those in its neighborhood, and separated from them by means of a fibrous capsule, which surrounds it and limits its dimensions.

"It is seldom as large as a millet seed. Its structure is comprised within a fibrous capsule, so that in many respects it is analogous to an encysted parasite. It consists essentially of one or more giant cells, usually placed centrally, from whose periphery numbers of processes radiate outward, which, by dividing and subdividing, constitute a reticulum, in which leucocytes with small giant cells are more or less abundantly contained. The reticulum terminates in the concentric fibrous capsule at the periphery." He further states, that he has found these structures *constantly* in what are called military tubercles; and they are found in the same organs and neighboring parts in which softening caseous masses are situated.

Hamilton applies the term tubercle to these peculiar structures, excluding the "caseous masses," regarding the latter as the result of what he calls "caseating catarrhal pneumonia." In severe cases of chronic catarrh, in chronic interstitial pneumonia, and in some cases of chronic pleurisy, he finds these tubercular elements in the tissues involved, and seems to regard them as produced by "caseous infection" from surrounding parts, and particularly from softened caseous masses resulting from the obliteration of the small arteries. From the situation the tubercles occupy, around bronchi and arteries, at each side of the lobular septa, and in the deep layer of the pleura where lymphatics abound, he thinks it extremely probable that they originate in the lymphatics. From his observations he concludes that in interstitial pneumonia the giant cells of the tubercles are

distinctly independent or neoplastic after. Neoplasm, he said, is a conventional term, not indicating origin. Tubercle, he further said, has manifold relations to inflammation; but, still, tubercular deposits may occur without inflammation in the ordinary sense of that term. Giant cells should be distinguished from a conglomeration of smaller cells, each having a nucleus. Multinuclear cells are composite, and are different from giant cells. Giant cells, though occurring in tubercle, are not confined to this form of pathological material. He believes tubercle may be formed without any previous tubercle from which it is derived, or without a previous caseous mass, or, indeed, without any pathological process other than that properly belonging to the production of the tubercle. Yet a multitude of processes might lead to tubercular eruptions.

These views, stated since this article was written, have been introduced to give weight to the general opinions which an effort has been made to express.

formed from the lymphatic endothelium, that these throw out processes, become encysted, and in time are developed into miliary tubercles.

It is claimed by Charcot, Thaon, and others who contend for the unity of phthisis, that the miliary tubercles conglomerate together and undergo changes which transform them into caseous matter. This is in all probability true. But it is also averred by them that caseation is peculiar to tubercle, and the existence of caseous matter proves the preceding existence of true tubercle. This is probably not true.

According to Virchow, Niemeyer, and others, the term phthisis can be applied with equal propriety to chronic miliary tubercle and caseous pneumonia. This is claimed by the new French school to be disproved by the researches of Charcot, Thaon, and others. But this is a question of the use of terms. The meaning of the term phthisis is wasting—from the Greek verb literally signifying “I waste away”—and phthisis pulmonalis may properly be applied to wasting disease of the lungs. If, then, caseous pneumonia causes wasting of the lungs, this may be called phthisis, and that it does may be disbelieved, but it has not been disproved. The question of fact, aside from that of the use of terms, is as to whether an inflammatory process may produce exudates which undergo a process of caseation, of breaking down, and wasting of the lungs, independent of a primary specific neoplastic formation which latter is not the result of inflammation. As there are differences of opinion upon this question among those who are regarded as authorities in pathology, it must be held as unsettled.

A formulation of my own views on the subjects discussed would be as follows :

1. That pulmonary phthisis is a perversion of nutrition in the lungs, in which there is a production of a material of low organization and vitality, which involves the tissues of these organs, and which tends to a breaking-down and wasting process.

2. That this low-lived material is in some cases a neoplasm, which commences without a distinct or full-formed process of inflammation, but that it is usually at an early period, and perhaps always later, accompanied by that process.

3. That an inflammation under particular circumstances may produce exudates and proliferations which undergo cheesy degenerations, and break down and produce destructive processes in the lungs; but in a majority of cases, though probably not in all, during the progress of this inflammation and caseation, true tubercle is developed, invading the lung tissue, becoming itself caseous, and aiding in producing destructive changes in the organs.

4. That acute general tuberculosis may occur, miliary tubercles

being developed in the lungs, in serous and mucous membranes, and other organs and tissues, sometimes exciting inflammation and its consequences, but generally destroying life without the occurrence of cheese-like degeneration, and without any breaking-down process.

5. That primary tuberculosis depends upon a peculiar diathesis, often inherited, but not unfrequently acquired; is liable to be developed or produced by unfavorable hygienic conditions; but that more or less of this tendency exists wherever true tubercle occurs. Whether this tubercular material is possessed of specific germs, capable of being communicated as a contagium, is at present undecided.

6. That three leading varieties of phthisis—primary tubercular, primary catarrhal, and primary fibroid—may be recognized; the last two inflammatory in their origin; the catarrhal commencing as an inflammation chiefly of the bronchi and the alveoli; the fibroid as an inflammation chiefly of the connective tissue; but as each form of the disease advances, the elements of the other forms are generally added, they lose more or less of their primary distinctive characters, and are all apt to be merged into a unified common pulmonary consumption.

7. That in many cases the processes of tuberculization and inflammation commence nearly or quite simultaneously—the inflammation involving various tissues while the tuberculous growths commence in different tissues also, often in the alveoli, and according to some around the terminal bronchi, or in the adenoid or lymphatic glandular tissue. These lymph glands, or whatever part be the seat of the deposit, enlarge, involve other structures, and the tuberculous matter becomes mingled with inflammatory products; and all together undergo caseous degeneration, and finally soften and cause ulcerative processes in the lungs.

Pathologically all these varieties exist, but clinically they are not always distinguishable, and we are often obliged to pronounce a case phthisis without determining which of the elements most abounds.

There are some cases which will be recognized as inflammatory in their origin—bronchial or interstitial—called catarrhal or fibroid phthisis. Others must be considered as primarily tubercular, and in these cases the patients have generally a strong hereditary taint, a narrow chest, a delicate and feeble organization, often a precocious intellect and character, which have been previously described as the tuberculous diathesis. Some, however, present evidences of the scrofulous characteristics which Sir William Jenner distinguishes from the tuberculous. In both these diatheses, whether or not they are clearly different, as Jenner holds, there is a lowered vitality, and persons with these tendencies are more subject than others to phthisis.

Consumption, then, has its varieties, which should be recognized

pathologically and clinically, but still it possesses a certain unity which is the ultimate clinical feature.

As truly expressed by Dr. Pollock, senior physician to the Brompton Hospital for Consumptives, London (Harvinian Lectures, 1881): "Phthisis is multiform, but has family features connecting all its varieties." He, however, goes on to say, as though this were always the case, that tubercle when found is a secondary superadded result arising from reabsorption of inflammatory products, which I believe is very often but not always the case.

Pathological Anatomy.—After the discussion which has preceded, a further brief account only will be required of the anatomical changes of phthisis.

In the account of chronic bronchitis the extension of the disease was described and its occasional termination in phthisis was noticed. This will render a full detailed description of the process unnecessary. The pathological account of some cases of bronchitis and bronchopneumonia already given is substantially that of catarrhal phthisis. The alveoli, the peribronchial, and to a more or less extent the connective tissue, become involved in a subacute and persistent form of inflammation; the alveoli are filled with corpuscular material; hyperplasia and exudates occur in the tissues outside of the bronchi; caseous degenerations take place; tubercles are usually developed; necrosis, softening, and ulcerative processes at length supervene; the bronchial membrane is hyperæmic, tubercular nodules are often found within it; the larynx and trachea in a certain proportion of cases have tubercular deposits and ulcerative processes, and the ordinary symptomatic phenomena of phthisis occur. In some cases the course of this form of the disease is comparatively acute and rapid, while in others it is very slow and protracted, the substance of the lungs becoming affected after the catarrhal disease has long continued. In the acute variety, sometimes called *phthisis florida*, the temperature fluctuates; but it is often as high as 104° or higher, and the disease may run its course in a few weeks. In the chronic form it may continue for years, with exacerbations and abatements, but finally results in destructive changes. The inflammation thus occurring, whether more acute or chronic, is for the most part in the upper lobes, involving particularly the apex, and extending downward to a greater or less distance, sometimes affecting the whole of one lung and a considerable part of the other.

The *pathological anatomy of fibroid phthisis* has already been referred to under the head of Chronic Interstitial Pneumonia, and its symptomatic phenomena will be described further on. Some additional remarks respecting this structural change may be made here.

In all chronic diseases of the lungs fibroid alterations constitute an

important element, influencing the phenomena of these affections. The nutrition of fibrous structure, healthy or morbid, does not require a large supply of blood. The minute capillary vessels have less to do in supplying this than most other tissues. This fibroid proliferation seems to occur when the flush of active inflammation is past, or in those milder forms of inflammation where the vascular excitement is not great. In bronchopneumonia the deposits and growths which occur in the alveolar walls and the interlobular tissue, when not degenerating and breaking down into ulcerative and necrotic processes from obliterated vessels, produce an increase of interlobular tissue and a thickening of the cell walls. This connective tissue, slightly vascular or non-vascular, extends between the air-cells and between the lobules, reaching to the pleura, to which it is attached. The proliferation of this fibrous tissue partakes of the character of false membrane, and, following its law, in time contracts. This contraction compresses vessels and interferes with nutrition, and mechanically diminishes the size of the lungs involved. Not only are vessels compressed, but air vesicles are closed. Less blood circulates in such a lung, less air is received, and its function is much interfered with. The bronchial tubes are often dilated, the walls drawn apart by the contraction of the tissue without them and by the pressure of the air within; in old cases the pleura is contracted, the lungs are bound down and fixed, and the immobility of the chest walls, so characteristic of cases of chronic phthisis where this condition prevails, is marked. In the portions of the lungs not thus affected compensatory emphysema may take place. Deficient aeration of the blood produces cyanosis; clubbing of the fingers and toes is apt to occur from increased fibroid growths; the diaphragm is drawn up, the intercostal spaces are drawn in, and when one lung is chiefly affected the opposite one is drawn past the median line. More or less of this connective tissue change, or of this cirrhotic condition, occurs in nearly all cases of chronic phthisis.

As the result of obstructed circulation through the lungs, the right side of the heart becomes dilated or hypertrophied, and general venous congestion with its consequences may result.

Dr. Pollock denies that there is such a thing as primary fibroid phthisis; but certainly the connective tissue of the lung, as well as that of the liver or kidney, may be primarily, or at least chiefly, affected, and in the forms of phthisis produced by alcoholism, this seems often to be the case.

This fibroid material is less likely to undergo degenerative processes than other inflammatory products, or than tubercular material, and often for a time serves as a safeguard to the patient, limiting ulcera-

tive and destructive processes ; fever and other active changes diminish, and the patient may survive a long time, especially if the disease be limited to one lung. But degenerative changes, easeation, softening and breaking down at length may occur, the other phthisical elements make their appearance, and death, as in other cases, follows.

THE PATHOLOGICAL ANATOMY OF PULMONARY TUBERCULAR PHTHISIS.

The differences of opinion as to what shall be called *tubercle* will not here be discussed, but the term in this description is restricted to the gray granulations and miliary tubercle, which, however, may be agminated into larger masses. These may undergo a cheesy metamorphosis, or may dry down into a horny-looking substance, or may become calcareous, incapsulated, and comparatively obsolete.

These primary tubercular neoplasms, according to Rindfleisch and others, are first developed in pulmonary phthisis around the bronchioles, especially the terminal ones ; while in the parenchymatous glands (kidneys, testicles, etc.) they first appear around the tubular elements. Hamilton, however, says : "After investigating many instances of *primary* tubercle of the lungs, I find that in all of them the first thing noticed is a little cellular projection on one side of an alveolus. Where three alveoli lie adjacent to each other, the embryo tubercle may project into the whole of them simultaneously." This projecting cellular mass is caused by an interstitial thickening of the alveolar walls, so that it may protrude into more than one at the same time. As it grows into the alveolar cavity it carries the capillaries of the air-cells with it, and also the epithelium of the part. The capillaries at this early stage are engorged with blood, and occasionally slight extravasations are seen, blood corpuscles being in the air vesicles.

At this stage the tumor consists of large spherical or flattened cells, with well-defined nuclei. They are granular in appearance, are actively germinal, and appear to Hamilton to come from the connective-tissue elements of the alveolar wall, or from the endothelium of certain of its capillaries. He is quite confident the connective-tissue element is the principal source of the tubercular cells. The small vessels are obstructed and the blood delayed in its circulation, and a reddened appearance of the parts results. Before long, a marked change occurs in this projecting and often pediculated tumor. It loses its envelope, and the cells contained within it escape into the cavity of the air vesicle ; and joining with other similar projections taking a like course, the alveoli become much distended. The capillary vessels which were over the surface of the projecting tumor disappear with the destruction of the envelope ; and three or more air vesicles, whose

walls are now scarcely visible, are together distended with larger endothelial-like cells, with occasionally some blood corpuscles. In this stage the tubercle growth somewhat resembles the exudate of catarrhal pneumonia, and the two conditions have been confounded. Mr. Hamilton thinks this has misled M. Charcot, and caused him to regard catarrhal pneumonia and tubercle as the same; but Hamilton regards their non-identity as clearly proved.

The alveolar walls being broken through, they are incorporated with the large cells before mentioned, so that a uniform rounded mass results. Besides growing thus in the alveolar walls, the tubercle spreads from the inner coat of a branch of the pulmonary artery, sometimes occluding a vesicle of considerable size. Wherever the little tubercular mass is formed, what are called "giant cells" make their appearance. The origin of these typical cells is a subject upon which there have been many differences of opinion among pathologists. Thaan thought they were merely blood-vessels filled with coagula. Klein thought they might be developed from lymphoid cells or leucocytes, or from the alveolar epithelium. Virchow supposed them formed from connective-tissue corpuscles, while Wagner and others thought them formed from cells of different kinds, but more especially from those of the vascular walls. Hamilton is of the opinion that each of these giant cells is produced by enlargement of one of the connective-tissue elements constituting the early tumor.

It will be remembered that in the introductory part of this work (p. 14, vol. I.) the different embryonic layers were mentioned, and the suggestion was made that a knowledge of the facts there stated might aid in an understanding of the nature of pathological changes. It is found that all the connective tissues are built up on the same plan, and are derived from the middle layer of the embryo. The materials employed in building up these connective tissues are, first, a matrix; and second, nuclei, corpuscles, or cells, as they may be called in their various stages, which lie upon the matrix, and that serve the purpose of supplying nutrition to it and keeping up its repair. This matrix material is incapable of further development, and is only subject to retrograde changes. The nuclei or corpuscles are protoplasmic, and undergo various changes under morbid stimulation. The changes of inflammation, of hyperplasia, and of neoplastic growths, have their chief seat in these corpuscles. The kind of change depends upon the character of the irritant, upon the susceptibility of the part, and the condition of the general system. In a pathological growth, such as a sarcoma, the irritation is persistent and often cumulative—the material of the growth itself perhaps acting as an excitant of further growth.

The cells, as in the case of inflammation, assume an embryonic condition, and expend their force in multiplication, without going on to the production of full-formed healthy tissue.

Giant cells are found in different morbid products, and are believed to have a similar origin in all. In myeloid tumors of bone they are found typically, and are also found in sarcoma. Tubercle in its early stage strongly resembles a sarcoma, but as it is further developed its more specific character appears. This principle is common to the beginning of many productions; embryos have striking resemblances, and differences come after.

The irritation which produces a tubercle does not continue active long, and the growth does not go on like a sarcoma. The proliferation of the cells diminishes in time, and a small fibrous structure is formed by their elongation. Before going to that extent some fibres form, holding together the cell elements.

The subsequent course of these primary tubercles will be considered in connection with the course of secondary tubercles, the origin of which will now be briefly noticed.

Genuine tubercles, when once formed, have much the same characteristics, but the cause and mode of production differ in different cases.

By *secondary* tubercle of an organ is understood tubercle following other morbid processes in the same organ, and dependent upon them. The condition which most frequently produces this form of the neoplasm in the lungs is the softening of a caseous mass in these organs.

Catarrhal pneumonia in its advanced stages, and interstitial pneumonia, or pulmonary cirrhosis, especially with bronchiectasis, are the common causes of caseation which results in the production of secondary tubercle. This interstitial pneumonia, with fibroid hyperplasia, is not unfrequently secondary to bronchitis and bronchopneumonia. It occurs in most chronic diseases of the lungs, as already stated. Sometimes it is the main pathological state; but, however produced, it is subject to cheesy degeneration and necrotic decay, chiefly brought about by pressure upon, contraction, and obliteration of the blood-vessels which maintain its low nutrition, and when such degenerative processes occur, tubercles in the region are likely to be produced. They are supposed to be caused by infection from the cheesy matter.

The situations these secondary tubercles occupy depend upon the distribution or course of the lymphatic vessels passing from the source of this caseous infection. The caseous decomposing matter is believed to be absorbed by the lymphatic vessels, and to induce the growth of tubercles within them. These matters abound most in the bronchi-

ectatic cavities, and these cavities are situated mostly in the apex of the lungs. These secondary tubercles, then, abound in the top of the lungs, and are incorporated with the interstitial tissue. Lower down they are more scattered, and can be better seen. They are of the size of a mustard seed, are gray and gelatinous in appearance, and are inseparable from the lung tissue. They are in the coats of arteries and bronchi, in the interlobular septa, and the deep layer of the pleura. They are small hard masses, and have the same anatomical features as the primary tubercles, but their distribution is along the course of the lymphatic vessels instead of in the alveoli.

In the secondary tubercle from catarrhal inflammation the same distribution occurs, and essentially the same characters are presented.

WHAT IS THE FUTURE COURSE OF TUBERCLE ?

As stated; the structure of a genuine tubercle of the kind we have been considering, when mature but not degenerated, consists of one or more giant cells with a fibrous net-work. It may have its characteristics destroyed either before or after its full development.

Its most common degeneration is that of caseation, and the primary is probably not as long-lived as the secondary. The caseous softening commences at the centre, and often produces a microscopic cavity, and when the softened matter is absorbed away, the mass contracts. This softened matter is carried by the lymphatics to other points, and produces other tubercles by infection. Their presence excites inflammation, more fibroid material results that in turn undergoes destructive processes; cavities are formed, often small ones, by dilatation of bronchi, and larger ones by ulcerative processes, and thus the disease is propagated and extended.

Another degenerative process of tubercle is the fibroid, a kind of vitrification. It now loses its cellular character and becomes a small fibrous mass.

The anatomical characteristics of these tubercles, as given in the French New Dictionary of Medicine, are :

1. Nodular form ; elements arranged concentrically around a centre.
2. A tendency to vitrification, or caseation of the central part.
3. Absence of vessels.
4. Frequent existence of a giant cell in the centre.

The author of the article in this French national work applies the term *tubercle* to the nodules which others consider the result of bronchopneumonia or interstitial pneumonia, and he follows Charcot in declaring that these cheesy materials, which so many pathologists

attribute to an inflammatory process, are nothing but a mass of miliary tubercles, which are called peribronchial nodules, and have absolutely nothing in common with the results of the inflammatory process.

This, it seems to me, must be regarded as an unwarrantable statement; but yet I must think the inflammation, for inflammation I believe it to be, which produces these cheesy masses is different from an ordinary inflammation. The different caseous pneumonias of authors—the acute form, simulating lobar or lobular pneumonia, the lobular bronchopneumonia; subacute, producing “galloping” phthisis; and the chronic caseous bronchopneumonia, constituting many of the cases of common phthisis—are modified from common or simple inflammation, and are likely to be accompanied by genuine tubercle, probably independent of the infection from the absorption of caseous matter.

All agree that inflammation accompanies tubercle in all ordinary cases; some, as Charcot and his school, contending that the inflammation is secondary and tubercle primary; while others regard the inflammation as primary and the tubercle as secondary. That both inflammation and the deposit of tubercle exist in phthisis, as a rule, is quite certain.

Production of Cavities.—The formation of cavities in phthisis is a matter of interest. It seems now to be admitted that the earlier cavities are produced by dilatation of the bronchi, from softening of their walls, from contractions without, and from pressure of their air within, especially in those branches where the alveoli to which they lead are so obstructed as not to receive the air. The walls of the bronchi often give way from the softening process of disease; the air vesicles also are often invaded and destroyed, and several smaller cavities uniting produce a larger one embracing an entire lobule, and several of these uniting form one still larger. Destructive changes often progress, lung tissue breaks down, and fragments are found in the sputa. Suppurative and ulcerative processes go on, and *consumption* of the lungs is the result. In these changes decided fever occurs, the temperature often rises to 104° , and sometimes 106° , and this fever is often difficult to control.

The subject of *pulmonary hemorrhage* has been discussed, the frequency of bronchorrhagia and the infrequency of pneumorrhagia were pointed out. The severity of the latter, as compared with the former, was stated.

Pneumorrhagia, when occurring in advanced stages of phthisis, is from branches of the pulmonary artery invaded by the destructive processes going on in the cavities. The arteries on the walls of the

cavities become dilated and aneurismal, and, deprived of the support of the lung tissue, yield to the blood pressure, and the hemorrhage may be profuse and terminal. Clots will be found in the cavities and in the bronchi on *post-mortem* inspection. Such hemorrhages are only occasional. Many cavities have a less vascular surface, secrete pus, and give rise to more or less free purulent expectoration. The main source of the expectoration in most cases, however, is the bronchial membrane, which is more or less inflamed, and produces a secretion abounding in cells, mucous or purulent, and sometimes semi-plastic.

From these views of the pathological anatomy of tubercle, and the caseous and fibroid pneumonias (and they seem to me fairly established from the most recent and most reliable investigations), the correctness of the propositions given as a summary of my opinions on the pathology of phthisis appears to me sustained.

Before proceeding to the symptomatology of the disease, one further pathological fact requires to be pointed out. In all the forms of phthisis pulmonalis three pathological stages occur :

1. That of crude deposit or growth.
2. That of degeneration and softening of the deposit or growth.
3. That of necrosis, ulceration, and excavation of the deposit or growth, including the lung tissue.

An additional stage exceptionally occurs of phthisical material becoming fibrous and horn-like or calcareous, incapsulated and obsolete, remaining for an indefinite period quiescent, the formative process ceasing ; and, in some cases, where cavities have formed, they remain stationary for a long time, and healing may take place, cicatricial tissue only being left to indicate the former disease.

This result is comparatively rare, but in no disease is more positive evidence of cure furnished by anatomical inspection than in consumption.

The further treatment of the subject of consumption will be from a clinical stand-point, and it will be best considered in some respects as a single disease, but with particular descriptions of its varieties in causation and pathology, as well as of its variations in respect to its symptoms and course.

OUTLINES OF THE SYMPTOMS AND COURSE OF CONSTITUTIONAL CHRONIC PHTHISIS PULMONALIS.—PRIMARY TUBERCULOSIS.

This part of the subject may be treated more briefly, for though the symptoms are of much interest and are generally varied, they are open to observation, and there are few who have not witnessed the course of a greater or less number of cases.

A predisposition to phthisis may be manifested early by the features of the tuberculous or strumous diathesis described in an earlier part of the work. There is often a faulty conformation of the chest, which may be flat and narrow with the upper part contracted. Phthisically-inclined persons often have a marked tendency to take cold, and their respiration is habitually rapid and not easy. There is a delicacy of constitution and a peculiar susceptibility to external impressions. The skin is often thin, particularly smooth, and movable upon the subcutaneous tissue. There may be a delicacy of the stomach and an aversion to certain articles of food, particularly fats. The blood is often thin, and comparatively poor in red corpuscles. But these indications are often wanting in persons who are nevertheless strongly inclined to the disease from hereditary predisposition.

But everything which enfeebles, everything which conduces to general dystrophia, and especially to that of the lungs, prepares the way for phthisis even without special predisposition. Some infectious diseases, and particularly syphilis, increase the natural tendency, and most bad hygienic conditions have that effect.

The beginning is usually slow and insidious. There is a cough from time to time, more frequent at night, but scarcely noticed. There may be dull pain in the chest, but this is often wanting. *Shortness of breath on exertion*, and a slight diminution of strength, are more constant, but this collection of symptoms hardly attracts the attention of the patients. They are often surprised or first alarmed by a spitting of blood, or a more decided hæmoptysis.

Soon the general health is more affected. The disposition to fatigue and inaction increases, paleness and thinness gradually come on; feverish sensations are from time to time experienced, and perhaps night sweats begin. A diarrhœa not easily controlled may supervene, and the appetite and digestion fail, though a diarrhœa early is exceptional, and the appetite and digestion may remain good.

The cough, while remaining dry, becomes more frequent. There is slight depression at the upper and central part of the chest, with diminished motion when tested by full inspiration. The respiration gradually becomes more frequent, twenty-four to twenty-eight per minute, more or less, but dyspnœa may not be felt except on exertion, or from some kind of excitement. Sometimes there will be paroxysms of oppressed breathing without appreciable cause; but unless there be some complication, such as pleuritic effusion, engorgement of the bronchial glands, or ulceration of the larynx, the dyspnœa is not distressing at an early stage of the disease.

The cough soon becomes habitual, and is now accompanied with a scanty mucous expectoration; it is often more troublesome during

the night, and may be increased by lying in particular positions. It may or may not be accompanied with pain, and when there are more violent paroxysms it may induce vomiting. In children it may be so paroxysmal as to resemble whooping-cough, especially when the bronchial glands are much infiltrated.

The cough is at first dry, then a mucous catarrhal expectoration occurs, and at length the expectorated masses are of a greenish-yellow color, flattened in form, with jagged edges. Some particles are in strips or small pieces of a dull white color, and give a variegated aspect to the sputa. Occasionally some small fibrous cylinders are observed; and when there are bronchiectatic cavities the expectoration may become fetid and have a nauseous taste and odor. The quantity expectorated may reach to from six to twelve or more ounces in the twenty-four hours, diminishing again toward the last. The microscope may show the elastic fibres of lung tissue, indicating the destructive process. In some cases the expectoration becomes suddenly much more profuse, and is of a sero-purulent character. This indicates that an effusion into the pleura has found its way into the bronchi, and is being discharged.

Allowing the sputa to stand, sometimes two, three, or four distinct strata can be distinguished.

With the exception of the partially bloody tinge, which from time to time is apt to appear, true spitting of blood is usually absent after the early stage of the disease is passed. When it does occur, the quantity may vary from a few red spots, or a few tea-spoonfuls, to several ounces. The hæmoptysis is usually repeated for a few successive days, and when for some days longer the blood which has remained in the bronchi is ejected, it is of a dark brown color, almost black, and indicates that the flow has ceased, as the fresh blood is florid. Some patients are weakened and depressed by the hemorrhage, even when slight, while others, by the relief afforded to the congested lungs, feel better after than before it. These hemorrhages are sometimes frequently repeated, constituting hemorrhagic varieties of the disease. In advanced stages, from the causes already described, the hemorrhages are much more serious in their indications and effects. Hæmoptysis is more rare in children and old people than in the middle periods of life.

Pains from dry pleurisy, from intercostal and more diffused neuralgia, are often felt.

Auscultation and percussion furnish more positive evidence of physical conditions. Their agreement with the gravity of the disease is, however, far from being constant. Lebert says: "I do not like those tolerably frequent cases in which the general condition is bad, the fever intense, the marasmus progressive, whilst examination of

the chest shows relatively inconsiderable alterations." It is not rare, on the other hand, to find in the comfortable class of patients all the signs of phthisis, and even cavities, whilst the general condition is passable. The prognosis in these cases is much better than when there are few local alterations, but a bad general condition. The truth of this I have often seen illustrated.

Physical Signs.—The first physical signs in these primary tuberculous cases are to be found in the apex of one of the lungs, for almost never are both lungs attacked simultaneously. These signs are sometimes more marked in front, and at other times in the back. On inspection there will be observed a less free movement in the affected part in respiration; and usually, when this is the case, there is slight contraction in the same situation. The clavicle will be more prominent, and when the disease is more upon the posterior part of the lungs, and extends some distance down, the scapulæ will be more prominent, not fitting so accurately to the ribs.

On percussion sonorousness is diminished above and below the clavicle, or posteriorly, and often in both places at the same time. There is usually simple diminution of the sonorous and the vesicular quality—less intenseness and a higher pitch; but sometimes, the bronchi remaining free while the capacity of the air vesicles is diminished, a degree of resonance approaching the tympanitic sound may be produced.

On auscultation the respiratory sound is modified more or less, in proportion to the amount of consolidation. At first, it is sometimes simply diminished in intensity without other material change. Soon it becomes more harsh and higher in pitch, the expiratory sound particularly is prolonged, and the sound is bronchovesicular or more bronchial. The respiration is sometimes jerky, interrupted, or shaky; the smooth, steadily-continuous, rhythmical flow is interfered with. The precise significance of this mode of respiration is not perhaps determined, but it is not unfrequently present in these cases.

As the disease advances, all these sounds are accompanied by evidences of a catarrhal state of the bronchial membrane, often extending to the alveoli, confined, however, to the apex or upper part of the affected lungs. Bronchial râles, moist and dry, sonorous or whistling, subcrepitant and coarse crepitant sounds are heard, and these are sometimes accompanied by pleuritic friction sounds.

These sounds are more distinctly produced when the patient takes a full breath, breathing deeply and rapidly, or in connection with and immediately after coughing. By degrees these physical signs increase in intensity and extent, are perceived lower down, and in time extend to the opposite lung.

As dilatation of bronchi and small cavities occur, bronchophoric blowing, and, to a certain extent, hollow respiration are not unfrequent, for these signs are by no means always pathognomonic of a large cavity or of pneumothorax.

When an acute catarrh comes on, these sounds are more extended, diminishing again with the subsidence of this intercurrent inflammation.

As the disease advances, these crepitant sounds take a clearer and more metallic tone.

As the pulmonary circulation becomes more and more obstructed, the right heart has more labor in carrying it on, and its cavities are often distended, the precordial dulness is more extended, and the impulse is for a time greater and is more toward the epigastrium.

As the wasting process goes on, the heart at length becomes atrophied and tends to fatty degeneration, and failure of its power becomes evident.

Anæmic sounds are sometimes heard in the heart; and when the right upper lobe of the lung is contracted by cicatrization, the beat of the pulmonary artery may be felt and heard.

The signs of cavities are often obscure and uncertain. Their existence is probable when the respiration and voice sounds are bronchial, intense, and superficial, and are circumscribed and limited. Change in the sounds of percussion when the mouth is open or closed—duller when closed—is regarded as indicative of a cavity. When a cavity is extensive, the percussion note will vary according as it is empty or full, and the large hollow bubbling, when heard, will be nearly or quite conclusive. Whispering pectoriloquy will be presumptive of a cavity. The mobility will sometimes be increased when a large cavity is formed.

Complications.—Complications with pneumonia, with pleurisy, or with pneumothorax, will be attended with their respective signs and symptoms, which have already been described.

Complications of diseases of the larynx may make their appearance, sometimes at so early a stage and with such intensity as to appear the dominant disease. Oftener they appear later, sometimes as simple catarrh with hoarseness, frequently transient; but in other cases ulcerations result, sometimes almost latent, when neither the vocal cords nor the glottis nor the epiglottis are involved; but ulceration, especially of the epiglottis, is accompanied with distressing symptoms, among which are dyspnoea, and particularly great difficulty of swallowing. The food and drinks often pass into the larynx, and are thrown back through the mouth and nose. This disease of the larynx may lead to inanition; or from the suffering it induces, and sometimes

from swelling and œdema and suffocation, the fatal termination is much accelerated. "These ulcerations, though tuberculous in their origin, are sometimes arrested, and cicatrization occurs, with improvement in the general condition, though in some cases there is permanent loss of voice."

Fistula in ano is another complication which is not very unfrequent, sometimes occurring early in the disease, and sometimes later; and often the discharge from that part seems to diminish the cough and other pulmonary symptoms. Both this and the ulcerated epiglottis may attract the chief attention of the patient and physician, and obscure the diagnosis of a case.

Attacks of acute pneumonia sometimes occur in the course of phthisis. They are usually mild, induced by the local irritation of the tubercles, and involve the apex. In the early stages of the phthisis and of the inflammation they are readily arrested, often by a single full dose of morphine or Dover's powder, though more surely by free doses of morphine and quinine. At a latter period of phthisis an attack of pneumonia may prove speedily fatal.

Primary and more chronic pneumonias in tuberculous subjects, instead of terminating in resolution, often result in cheesy softening, in the formation of cavities, in hectic fever, and marasmus. The point of attack is generally in the superior lobe, but it may be in other parts of the lungs, followed by all the consequences mentioned. This form of pneumonia is said by Lebert to be more frequent in the monkey than in man.

Severe secondary pleurisy is more grave than secondary pneumonia in consumptive patients. When considerable effusion takes place, it is apt to be more or less purulent, the diseased condition is persistent, it is often double; and, though it may subside without serious consequences, it generally aggravates the course of the tuberculosis, and not unfrequently is the more immediate cause of death. Often there is an absence of pain in this form of pleurisy, and it is only to be detected by a physical examination. The purulent effusion may make its way by an ulcerative process into a bronchus, and its free expectoration may be the first evidence of its existence. When detected in the chest, tapping or aspiration is called for, and is usually followed by much relief.

Secondary pericarditis is rare, but possible, and may result from an ulcerative process in a suppurating bronchial gland.

Fatal pulmonary embolism is rare, but small emboli are more often seen. Thrombosis of a femoral vein sometimes occurs, extending possibly to the vena cava. It is known by its sudden occurrence, a sharp pain, and œdema of the limb.

Digestive derangements merit the most serious attention, as they greatly increase the exhaustion of the patient and hasten the fatal termination. Thirst is incident to the fever, is increased by the night sweats and the diarrhoea when they are present. The appetite, diminished by the fever, is often more completely destroyed by an obstinate gastric catarrh, accompanied by the usual dyspeptic symptoms. Vomiting may be accidentally produced by severe fits of coughing, but it may result from various complications, as gastric catarrh, chronic hepatitis, tuberculous peritonitis, or cerebral affections.

The bowels tend to be either regular or constipated during the early stages of the disease; but, later, diarrhoea is apt to supervene and to be obstinate. In a few cases enteric phthisis predominates—tuberculous disease of the intestines, with its consequences, occurs before detection of that disease in the lungs; but oftener the pulmonary disease precedes—the intestinal affection coming on after the disease of the lungs has made some progress, constituting pneumo-enteric phthisis. In such a case the abdomen is slightly distended, colics occur from time to time, the stools become more and more liquid, with from three to eight movements a day, and when the rectum is affected so that it will not retain the faecal matter, the discharges are more numerous but small in quantity, often accompanied with tenesmus. A diphtheritic dysenteric colitis may occur, and is usually terminal.

Perforation of an intestine occasionally, though rarely, takes place from tubercular ulceration, with a recognized fatal peritonitis following; and, toward the last, the ordinary symptoms may not be manifested, the real condition being revealed post mortem.

The liver is often fatty, especially in enteric cases, but it is not much enlarged. It is more thickened and compact, when, as happens in some cases, there is amyloid degeneration. Jaundice is rare.

Peritoneal tuberculosis not unfrequently occurs, but when it is secondary it is usually late in appearance and may pass almost unperceived. There will, however, be some pain on pressure, some irregularly distributed dulness over the abdomen, and sometimes distention, nausea, and vomiting. More primary and essential tuberculous peritonitis is quite different, and will require a separate consideration.

The *fever* and its course in pulmonary phthisis, of which little has as yet been said, is, however, of the utmost importance in the symptomatology of the disease.

It may not appear at all during the first months, or only for a short time toward evening.

Later, and sometimes from an early period, the patient feels chilly

near midday, and complains of heat and thirst, especially toward evening, but sometimes, when the temperature is decidedly raised, the sensations of heat are not noticed. The pulse is increased in frequency at a comparatively early period, the temperature rises a degree or two or more, and the rapidity of the progress of the disease is to a large extent measured by the amount of feverish excitement. The earlier the fever appears, and the higher point it reaches, the more rapid the progress of the case. It may be very slight at first, and intermitting, but it gradually increases in a progressive case, and at length is continuous, but with morning remissions. Sooner or later it generally becomes more distinctly *hectic*, and in that form is a principal cause of the general wasting. It sometimes remarkably resembles malarial fever in its chills and intermissions; and it sometimes assumes a more typhoidal type, which may lead to a false diagnosis. The more irregular distribution of the heat upon the surface, the disagreeable and debilitating rather than relieving sweats, and their coming later, commonly in the night, will serve to distinguish hectic from ague; and the typhoidal cases will be distinguished from typhoid fever by the history, the presence of tubercular disease, and the absence of the eruption and other marks peculiar to the specific typhoid fever.

The *pulse* at an early period of phthisis may have a tolerable degree of strength; but as the disease advances its fulness and tension diminish, while its rapidity increases, and toward the end it becomes small, thread-like, and very frequent. It ranges during the disease from 85 or 90 to 120 or 140. Cardiac feebleness toward the end may render it irregular, and a cerebral complication may retard it. Though there is a general correspondence, there is no fixed relation between the frequency of the pulse and the elevation of the temperature; and the temperature varies in different cases where other conditions are very similar. Toward the end, approaching collapse diminishes the feverish heat, and at the very last it may be moderate, but more frequently it rises to 103° to 104° F., or even more. The comfortable sensations some patients say they experience while the fever continues high, must not be regarded as a favorable indication. Intercurrent inflammations, particularly pneumonia, increase the heat markedly when occurring during the early stage, but have less effect upon the temperature when the disease is more advanced.

Changes in the urine are influenced chiefly by the amount of fever, though interference with the respiratory function, by diminishing oxidation, often results in an excess of urates and a comparative deficiency of urea.

A little albumen is not unusual in ordinary cases; but where a

larger quantity is found, and is constant, it indicates disease of the kidney. Tuberculous pyelitis and cystitis sometimes occur, when some pus and the phosphates are likely to be present.

The *alteration of the general health* is of great importance. While this is often in proportion to the progress of the local disease, it is by no means always so, and, in fact, there are very great differences in this respect.

In some cases the general health remains comfortable, while physical signs show progressive and extensive changes in the lungs; but, as before intimated, the case is more unfavorable when the general condition is notably deteriorated, while the physical signs are inconsiderable. Much depends upon the condition of the digestive organs, and the amount of food appropriated, but still more upon the amount of fever and the intensity of the general tuberculous cachexia.

The *gradual wasting* of flesh and strength in consumptives is too well known to require description.

Still, it is not unfrequently observed that with improvement of the digestive functions and abatement of the fever the emaciation is checked, and even flesh and strength are gained, notwithstanding the disease is slowly progressing.

Nervous disturbances vary in amount and character; but they generally arise from anæmia, though at an advanced period they may be the result of cerebral or meningeal tubercles and their consequences—hydrocephalus, paralysis, etc.

The *hopefulness* of consumptives is well known; but the mental state is often greatly influenced by external impressions. Hopes of benefit from particular modes of treatment and climate-cures are readily excited, too often, however, ending in disappointment.

The *mind* is commonly clear, though much feverish excitement may produce temporary delirium; and there are sometimes cases of phthisical insanity, and different mental abnormalities may be produced by cerebral complications.

When the kidneys are diseased, uræmic poisoning may follow, and in diabetic consumptives the special conditions of that disease will complicate the cases.

Diseases of the bones and joints sometimes complicate cases of phthisis, adding their own phenomena and hastening the end.

It is often stated that the *sexual instinct* is active in consumptives, and this is sometimes the case, though the catamenia cease in women when the fever is continuous and the disease is much advanced; and in men, as the disease advances, the sexual power generally declines much, and is often lost.

Before the disease is far advanced women are liable to become

pregnant ; but gestation, parturition, and lactation, particularly the latter two, hasten the fatal result.

Stages and Course.—The *course and duration* of tubercular phthisis, as well as the symptoms, vary much in different cases. The disease presents different phases, and has the three stages—the stage of deposit or growth of tubercular material, of softening of that material, and the ulcerative and wasting stage which follows. The phases and stages, however, run into each other, and there is no abrupt and well-defined line of demarkation between them. When the disease has advanced to the condition of ulcerative excavations in one part, softening will be going on in others, and in others still the deposits or growths will be taking place.

A Pretubercular stage may be recognized in some cases, while in others the disease is latent until a hemorrhage surprises the patient and friends, when, on examination, considerable advancement in the local affection will be discovered. The pulse and physical signs in some cases may show but slight change, while the increase of temperature and other symptoms are marked and almost characteristic. The importance of the use of the thermometer in the early stages of suspected cases will be seen. Neglect of this may lead to grave errors. In a case in a medical gentleman lately under notice, a neglect to use the thermometer led to a very serious mistake on the part of the patient and his advisers. The case was one where the physical signs were not well marked, and where the debility and emaciation were attributed to overwork. The patient was first aroused to even a fear of his condition by finding his temperature was ranging from 101° to 103° F., and sometimes more. The progress, after this discovery, was rapid. The rapidity of the course of phthisis and the duration of the disease are chiefly influenced by the amount of fever and inflammation which may be present; but the intensity of the tuberculous tendency and the hygienic conditions of the patient have their effects. In most cases the symptoms fluctuate more or less, and often temporary improvement in general symptoms is marked, while still the disease goes on, and each exacerbation reduces the patient more than any that has preceded.

The course may be either steadily progressive, remitting, intermitting, or sometimes permanently retrogressive, and in this latter case with more or less impairment of the lungs, but with a comparative cure.

The disease may be *latent* throughout its course—that is, the ordinary external symptoms may not be manifested; and this is more frequently the case in women than in men. The conditions of hysteria, pregnancy, and pelvic diseases may hide the symptoms. In

insanity, the phthisis is often obscured ; but in all these cases a careful physical examination will usually reveal the character of the disease. The *duration* may be from a few months to several years ; and the mode of death in an uncomplicated case is usually by gradual asthenia ; but often there is apnœa at last, from accumulations of sputa in the air passages without the power of expelling them.

Secondary lesions or complications often hasten the fatal result. There may be extensive disease of the mucous membranes—alimentary as well as respiratory—and, as we have seen, fatty degeneration of the liver, perforation of the pleura, ulceration and œdema of the glottis, or œdema of the comparatively sound portions of the lungs, hemorrhage, pneumonia, acute bronchitis, pleurisy, empyema, peritonitis, uræmia, or diarrhœa may occur, and any of these may be the immediate cause of death. Sometimes death occurs very suddenly, when the patient has been able to be up and take exercise, and even to continue business, from fatigue and suspension of action of a debilitated and possibly fatty degenerated heart.

This description of the symptomatic phenomena of primary tubercular phthisis, together with the account which has been given of its pathological anatomy, will, it is hoped, furnish to the student a satisfactory and scientific outline of this most widespread and fatal disease.

The account of phthisis would be far from complete without a more particular reference to some of its other leading varieties. This article, however, would be extended to an unreasonable length were an attempt made to present every phase the disease may assume.

But the *catarrhal* and *fibroid* varieties, as they are recognized pathologically, are equally entitled to a clinical recognition.

CATARRHAL PHTHISIS.

Phenomena.—Catarrhal phthisis usually commences with a bronchitis or a bronchopneumonia, which assumes a chronic form. The inflammation extends to the peribronchial tissue, to the air vesicles, and at length to the interlobular structure. The disease is mostly developed in the upper lobes, and in one lung earlier than in the other. It is in disseminated points or foci, and leads to cheesy deposits commonly accompanied with true tubercular formations.

In primary tuberculous cases the cough is dry for a considerable time ; but at length a mucilaginous expectoration occurs, and this, sooner or later, is followed by mucous, muco-purulent, and further on by tubercular matters, and by fragments of lung tissue. In catarrhal cases early expectoration is more abundant. If it be tenacious mucus

at first, with yellow spots in the sputa afterward, the catarrh has reached the smaller bronchi. Later still, streaks of blood are sometimes seen, with bronchial and alveolar epithelium in a state of fatty and granular degeneration, and chronic bronchiopneumonia is present. In catarrhal phthisis, cough and expectoration precede pallor, weakness, fever, and emaciation; while in primary tuberculosis, these symptoms precede much expectoration, or anything more than a hacking cough. When an advanced stage is reached, the expectoration in the morning is thick, yellow, greenish, opaque, especially after a quiet night, but it is less opaque during the day. As the destructive process is established, lung tissue may be mingled with it; and in this as in other respects, the symptoms are scarcely distinguishable from those of primary tuberculosis. In catarrhal cases, the fever is at first moderate in proportion to other symptoms; but when the alveoli are reached, the temperature rises to 102° or 103° F., and continues high while the pneumonic process is extending. There is, however, no uniformity of temperature in these cases, as the tuberculous element is sooner or later added; but in the earlier stage the temperature is seldom above 100° in the morning, and 102° in the evening. When the fever is much higher and more continuous early, the disease is probably primary tuberculous, and is rapidly advancing. Hectic is developed in the latter stages of primary catarrhal, as in primary tuberculous cases.

The pulse is accelerated less in the early stage of the catarrhal than in that of the tuberculous variety, with the same amount of cough and other local symptoms, and it is less varied by mental excitement or physical exertion. In the latter stages the difference in the two varieties in this respect is not marked. Emaciation is not as great in the early stages of the catarrhal as in the tuberculous disease.

The primary catarrhal is not ushered in by hemorrhage, as is the primary tubercular, though in both alike it may occur later. As already stated, the latter stages of all the varieties merge into one general form.

. FIBROID PHTHISIS.

The term *fibroid phthisis* is applied to somewhat different pathological conditions. In chronic bronchitis and interstitial pneumonia hyperplasia of connective tissue often supervenes, and indeed in all forms of chronic phthisis more or less of this condition occurs. But a chronic inflammation of the connective tissue may be the earliest, and, if not the sole, it may be the chief condition. When this is the

case, the symptoms vary from either of the other forms of consumption.

This form frequently occurs in persons of ordinary or even superior physical development. It may follow croupous pneumonia, or may arise from exposure, and particularly from intemperance in the use of alcoholics. It is sometimes associated with Bright's disease of the kidney, or with cirrhosis of the liver, and similar changes in other organs. It is commonly slow in its approach and course. Among the earlier symptoms is a cough, often dry, ringing, and spasmodic. The fever is very moderate, and sometimes almost entirely absent. The pulse is not rapid, and emaciation is but slight. Attacks of hemorrhage sometimes occur, but they are not common. The morbid change is not as likely to be confined to the upper lobes as in the other forms of phthisis, and many cases will yield to early and persistent treatment—much more than the primary tuberculous forms of the disease.

Indeed, not unfrequently in cases where contraction and induration of the lung to a considerable extent have taken place, when there is thickening of the pleura, and fibrous bands have extended through many parts of at least one lung, and where cavities of dilated bronchial origin have formed in different parts, the morbid process may abate, progression cease, and with impairment of lung function, but in tolerable health and comfort, the patient may continue many years. He is, however, liable to a return of the symptoms. The disease may at any time take up its rôle, attacks of acute inflammation are likely to occur, cheesy degeneration of the fibroid material may take place, and tubercles may be developed, destructive processes may follow, and the usual termination of phthisis result.

When the disease advances without interruption, cheesy degenerations, bronchial dilatations, pulmonary collapse, and the other pathological states already described, with tubercular deposits and a final breaking down of tissue, will take place at an earlier period, and the symptoms will assume the character of those common to the latter stages of all forms of pulmonary phthisis.

Still other forms of phthisis than those described are mentioned by different authors. Thus Lebert, in his last great work on consumption, recognizes the following varieties :

“1. The latent form, which for a long time gives rise to no characteristic symptoms. 2. The more common form of chronic disseminated bronchopneumonia, beginning with signs of an affection of an apex, or a superior lobe, extending downward and then on the other side, and giving rise to the typical symptoms. 3. Chronic, interstitial,

disseminated pneumonia, with its cicatricial tissue, dilatation of bronchi, etc., leading more slowly to extended infection, unless it is complicated with disseminated bronchopneumonia, as it often is, when the course is more rapid.

“4. Diffused pneumonia passing to the cheesy state, causing dissemination of foci, the melting of some into cavities; but this form is rare.

“5. Pulmonary phthisis, secondary to some other primitive tuberculous localization—peritoneal, lymphatic, osseous, etc.

“6. Masked forms from the predominance of symptoms from localizations outside of the lungs—laryngeal, enteric, pleuritic, nephritic, etc.

“7. Phthisis from a mechanical cause disturbing the pulmonary circulation, as by stenosis of the pulmonary artery.

“8. Traumatic phthisis, as from a fall, contusion, or blow upon the thorax.”

Each of these is regarded as having something peculiar in its symptoms and course.

There are differences in the phenomena and course of the disease dependent upon the *localization*—upon the massing together of the phthisical material at the apex, or its diffusion over a large extent of pulmonary space. The cases where the local disease spreads over a large surface, Dr. Pollock asserts, tend to chronicity. These cases usually occur in chests large and well formed; the impaired movements are over a large surface, or are not perceptible. Flattening, if noticeable, is also over a large surface, and dulness on percussion is moderate but diffused; and all the signs of deposit are less concentrated than in ordinary cases, shading off with considerable uniformity from the apex to the base of the lungs.

Bronchial respiration, if heard at all, is only in patches of limited extent, and crackling rather than crepitant râles, with a dryer tone than in ordinary cases, will be observed, if such adventitious sounds are heard at all. There are occasional hemorrhages in these cases, and a free flow of blood may result in the production of cavities, but they are comparatively rare in this form of the disease.

Attacks of pleuritis are common, and extensive adhesions often result. Fever, however, is often absent for long periods together, and the prognosis as to time is favorable.

This form of phthisis occurs more frequently in men than women, oftener at a later time of life than most other cases, and the disease usually affects both lungs. The deposit is chiefly fibroid, but tuberculous and other low-lived forms of bioplasm are present.

But in consumption of whatever form, and apart from all theories

as to the origin, the tissue seat, or the special character of the deposits, the three stages which belong to all forms of the general disease—that of deposit and blocking up, of softening and commencing ulceration of the lung tissue, and the formation of cavities of considerable size from ulceration and necrotic processes—are present, and each is marked by modifications of the symptomatic phenomena.

Decided and perceptible deposits may occur in lungs and remain for years nearly or quite quiescent—the patient continuing in fair health, and perhaps after long periods dying of some other disease. But in whatever climate such a patient is, or whatever he does, he is liable to congestive attacks of the lungs, and during these he is feverish, has cough, wastes more or less, and not very unfrequently has some hæmoptysis. This, when a mere diapedesis, or from capillary vessels, often relieves the congestion, though it temporarily weakens and depresses the patient; and at length, even after repeated attacks, under proper care and treatment he may regain comparative health and comfort.

One of these attacks, however, may be followed by increase of symptoms—by inflammation, by increased deposits, by softening, ulceration, and decay.

During the periods of quiescence, the physical signs may consist of only a slight dulness on percussion, harsh breath sounds, and slightly prolonged expiration. When, however, the congestive attacks occur, the dulness is increased, crepitations may be present, and cough and expectoration are more marked. With occasional attacks of this kind the patient who takes care of himself may go on to old age; when, as the general powers of life fail, the deposits may be degenerated and break down, and the patient sink under senile phthisis.

In some of these mild and protracted cases, the phthisical deposit undergoes calcification, becomes incapsulated, or these chalky masses may work their way by slow ulcerative processes into the bronchial tubes and be expectorated. Such favorable cases are comparatively rare, but one who has much practice meets with them, and a knowledge of the fact that instances of this kind occur gives grounds of hope.

In ordinary cases, however, during the stage of crude deposit, the disease is progressive, and the symptoms already described are present. When the second stage or that of softening occurs, inflammatory symptoms supervene, and inflammatory products are increased; and these inflammatory phenomena more than any other circumstances influence the course of the disease. The nature of the deposit, whether chiefly tuberculous, cheesy, or fibroid; and its location, whether in circumscribed masses, or more diffused, or whether in

scattered groups, also influence the severity and rapidity of the disease.

During the softening changes the pyrexia is more decided, tending to the hectic character, the temperature running up to 103° , and even rarely to 106° , in the evening, but with a morning fall. Crepitant sounds are heard extending downward from the apex, preceded by clicking sounds, and often pleural friction sounds are added. Patches of dulness with blowing respiration and bronchophony are observed, accompanied or followed by adventitious breath sounds.

When these conditions are well marked and have made considerable progress, although there may be a pause in the morbid phenomena, the cases are usually progressive and fatal. While a decided inflammatory process with all its results is in progress around the deposits, of whatever character those deposits may be, the whole morbid condition is increased, and unless the inflammation is speedily checked, more deposits and the destructive changes follow.

The *third* stage of phthisis, as already stated, is said to be reached when masses of tuberculous or other deposits have softened and so affected the involved and surrounding tissues as to have produced cavities, especially if they are of sufficient size to be detected by hollow blowing respiration, by gurgling, and by pectoriloquy.

Small cavities produced by dilated bronchi, or by the softening and liquefaction of a small tubercular or cheesy mass, will not authorize the statement that the third stage is reached; but when there is such an aggregation of softened masses as to produce a cavity large enough to be detected, the disease has clearly passed into its third stage.

The seat of the first detected cavities is oftenest at the posterior part of the apex of one lung above the scapula, but it may be under the clavicle. But while cavities have thus formed, softening and crude deposits may be going on in other parts; and it is very rare that a single lung is alone involved when the disease at any point has gone to this extent.

When softening masses coalesce in such a manner as to obstruct the circulation in a large intervening portion of lung substance, necrosis occurs, and extensive excavations result. Auto-infection is then likely to occur, and the system is more profoundly affected than by many small isolated cavities.

The worst condition is that in which large cavities are forming, and still larger portions of the lungs are filled with softening and crude deposits. Then the cavities are apt to go on enlarging and burrowing without an effort at isolation, until large portions of lung are destroyed or the patient is exhausted. The inflammation produced by the softening of one portion of deposit induces more deposits,

self-inoculation with decaying matters continues to occur, and death follows. This is the usual sad history of the affection.

But a lung quite extensively infiltrated, but with large portions of healthy pulmonary tissue intervening, undergoes more slowly the softening changes which destroy surrounding parts.

In some cases, where the deposit is limited to one or both apices, though softening occurs, new deposits may be prevented by better hygienic conditions or by treatment, cavities may become lined and surrounded by plastic exudates, which may remain for a long time, the patient having impaired but comfortable health; and the contraction and healing of such cavities, with more complete relief from all symptoms, may take place. Cicatrices are not very unfrequently found *post mortem* where patients have died of other diseases. The well-organized fibrous surroundings seem to protect the adjoining parts from further invasion.

In such cases, if the consumptive *diathesis* can be changed, the patient recovers, but of course with impaired breathing capacity. Even where irregular cavities with more diffused deposits are present irritation may subside, nutrition may improve, and the morbid process may be slow, or for a considerable period suspended.

The third stage of phthisis is reached in a large proportion of fatal cases. In 556 such cases in Brompton Hospital, London, 500 were found on *post-mortem* inspection to have cavities.

ACUTE TUBERCULOSIS.

There is still another variety of tuberculosis which requires to be noticed, but which is scarcely entitled to the name of phthisis, as there is usually no wasting of the lungs.

Acute tuberculosis may present a variety of forms. There may be a latent form without characteristic symptoms, but where there is an abundant eruption of small granulations upon a number of organs simultaneously, the serous membranes suffering most. This is more frequent in children. In some cases the substance of the lungs is thickly studded with these miliary tubercles. Many years ago I reported a case where this form of disease occurred in a well-developed child under six months old, where the deposit was so extensive as to interfere with respiration, the most prominent symptom being extreme dyspnoea, and this appeared to be the chief cause of death. The course was very rapid, lasting only about two weeks from the first apparent deviation from good health, and only a week after the dyspnoea was sufficient to induce the parents to ask for advice.

In some cases of children who die from meningitis, on *post-mortem* examination tubercles are found in the lungs evidently older than those of the brain, and where no lung symptoms or other noticeable evidence of disease existed previous to the meningeal attack.

A case is related of a man falling senseless in the streets of Paris, who was conveyed to the Hôtel Dieu, and died the next day. His lungs were found crowded with tubercles. In these latent cases there will be a moderate fever, some weakness, and gastric disturbance, perhaps pain in the head, though no cough or marked dyspnoea; but the patients grow weak rapidly and die in a few weeks, when tubercles will be found in many organs.

There is a so-called *typhoid* form not very rarely occurring—its whole thermal history is, however, different from that of typhoid fever.

Patients complain early of extreme physical prostration, of headache and vertigo, and there is a tendency to delirium; they fall gradually into a sleepy state, sometimes becoming comatose; the pulse is very small and rapid, there is dryness of the tongue, a fuliginous color around the mouth and nostrils, a tendency to retention of urine or its involuntary discharge, and a tendency to bed-sores, rendering the resemblance to typhoid fever quite marked. There is, however, an absence of the specific eruption, of the peculiar abdominal symptoms, and though the fever may be high in the evening, its oscillations are greater and its course not as regular as in the specific fever. Death usually occurs within four or six weeks.

The *cerebral* form is where the membranes, and sometimes the substance of the brain, are seats of tuberculous deposit, and this is often a terminal form of acute pulmonary tuberculosis. The brain symptoms are usually active when the cerebral membranes are attacked, and, for a time, those of the lungs are obscured. The disease reaches a fatal stage in from ten days to three weeks. The termination may be even sooner by convulsions or paralysis.

The larynx, the peritoneum, the intestines, and other organs, may be the principal seat of acute tuberculous deposits, and the disease may linger a longer or shorter time, but the result is usually the same—death within a few weeks, or at most a few months.

According to Lebert's statistics, three fifths of the cases do not exceed six weeks, and about one fourth succumb in from four to six weeks. Only 3.5 per cent. survive from three and a half to four and a half months. Although the usual termination is death, some very rare cases temporarily recover, and subsequent death and autopsies show that the miliary tubercles in considerable abundance had existed long before.

Death in 65.5 per cent. in acute tuberculosis is from collapse, this

condition sometimes arising from cerebral anæmia, often with a typhoid appearance, or from syncope after exertion, or from severe dyspnoea; while death from tubercles of the brain occurs in 33 per cent., and in a much smaller percentage from peritonitis.

These cases of acute tuberculosis are mentioned in this connection from their relation to tubercular phthisis, differing from the latter in the more extensive and rapid formation of tubercles, and in the destruction of life before the softening stage of tubercles arrives. As a proof of the intimate relation of these forms of tuberculosis, I have seen in the case of a child four years old, dying of general miliary tuberculosis, small aggregations of tubercles in the lungs with softening and suppuration. In this case the fatal termination was delayed somewhat longer than usual, affording time for the softening process.

SOME SPECIAL SYMPTOMATIC PHENOMENA, DIAGNOSTIC AND PROGNOSTIC, IN CHRONIC PHTHISIS.

There are some special symptoms in consumption which have already been mentioned, but the more particular significance of which it is important to point out in giving a satisfactory account of this very common disease.

Persons with *flattened chests contracted at the upper strait*, who are easily put out of breath, who take cold readily, and have prolonged pulmonary catarrh with general debility, are particularly predisposed to phthisis. In such persons especially, and even in some with opposite general conditions, every prolonged, grave, and debilitating disease increases the tendency to phthisical affections. It is doubtful whether there are any such diseases which do not have this tendency.

The influence of *malaria* not only upon the production but upon the course of phthisis, has been a subject of discussion. That persons in the early, and even in the advanced stages of consumption, who have removed from New England to the new and malarious regions of the North-west, have had the disease of the lungs arrested while laboring under repeated attacks of ague, I have in a few instances had the most positive proof. In these cases the phthisical symptoms improved and nearly disappeared, and death from other causes has given an opportunity to observe *post mortem* obsolete tubercles and cicatrices from healed cavities. But whether this was the result of the malarial influence or of other causes—of other effects of the climate, and the changes in the modes of life incident to a new country—it is impossible to say. Lebert mentions obstinate intermittent fever, with the paludal cachexia, as an antecedent of consumption.

He places it in the same category with prolonged inflammation and protracted suppuration of the bones and joints, with nephritis of long duration, with glycosuria, and with *inveterate alcoholism*, as among the aggravators as well as causes of the disease.

The supposed antagonism between malaria and tuberculosis is not established, though among the pioneer physicians and people of the West such antagonism was believed to exist. The general observation of the profession rather sustains the view that the debility produced by malaria, like other debilitating influences, predisposes to the disease, though it is possible that in some cases the occurrence of ague may check its progress.

Lebert states that syphilis aggravates consumption where it exists, as well as that it certainly aids in its production.

Mechanical disturbance of the pulmonary circulation from diseases of the heart, he regards as an unfavorable complication, tending to the production of phthisis, or hastening its progress; and pregnancy, confinement, and puerperal diseases, especially if suppuration attends them, he believes aggravate and hasten on the phthisical phenomena.

Chlorosis may be a result, though not perhaps of itself a cause, of phthisis, and that, with hysteria, may mask the disease. Whatever view may be taken of the essentially inflammatory or non-inflammatory nature of tubercle, there can be little doubt that prolonged phlegmasia of the respiratory organs favors the development and at least hastens the progress of the affection.

The bronchitis of measles and whooping-cough develops any latent tendency to the disease more than ordinary bronchial affections; and the existence of obsolete tuberculous foci, though apparently healed, not only renders new attacks more likely to occur, but causes them to be more severe.

Feebleness and emaciation, with rise of temperature one or two degrees frequently occurring, not traceable to other causes, should always create a suspicion of tuberculosis, even in the absence of local symptoms or signs.

Dyspeptic symptoms may dominate in cases of phthisis, and thus mislead. So with urino-genital diseases, peritonitis, chronic nephritis, diabetes, osseous suppurations, and carcinoma. When such diseases are present, examinations of the chest should be made, and every indication of phthisis carefully observed.

Feelings of *dyspnœa* are often absent when the patient is quiet, and this should not be relied upon as excluding phthisis. In about one half of the cases *dyspnœa* is troublesome and complained of, but as an asthmatic element may be present, increasing this symptom, its

severity is not always a measure of the extent of the tuberculous disease. When the dyspnoea is paroxysmal, its occurrence is usually in the night.

Emphysema is often regarded as preventive of tuberculosis, but whether it has this effect is not so clear. It does not, however, seem to favor the development of tubercles, and its presence should not excite fears of consumption.

Cough, though so commonly present and characteristic, may be absent, and its absence should not prevent a careful investigation where other symptoms excite suspicion of phthisis. In two fifths of the cases it is distressing, and in hysterical patients with phthisis it is often spasmodic and ringing. Generally late in the disease the cough is excited only when there are considerable accumulations in the bronchi.

The *expectoration* in phthisis varies, and only in occasional cases is it characteristic, distinguishing it from other pulmonary affections. After some months there is generally expectoration of a mucous and more or less watery character; later it is thicker, with little masses, composed of altered epithelium and purulent cells inclosed in mucus. Later still, the sputa are compact, grayish yellow, opaque, and sometimes confluent, markedly purulent, and sometimes bloody. Sometimes there are compact masses, composed of several smaller round masses. Sometimes portions of phthisical sputa will float on water, while some amorphous matter will cover the bottom of the vessel. In many cases there will be seen streaks and spots of dead, yellow-white matter, with a dull cheesy look—a granular detritus from disintegrated and decomposing material. In women, during menstruation, the expectoration is often bloody, but this has no serious import. Fibrinous bronchial casts are rare in phthisis, and when occurring indicate a plastic bronchitis.

When cavities are forming expectoration for a time may be diminished, but when they are fully formed the expectoration is more free. The expectoration from cavities is not distinctive, unless offensive from retention and decomposition. In some cases the sputa are in the form of pieces of money, but with ragged edges.

When destructive processes are going on, elastic fibres are sometimes found in the sputa by a microscopical examination. This is characteristic, and was first pointed out by Lebert in 1844, and by Van der Kolk later.

Sometimes a free quantity of sero-purulent fluid is suddenly thrown up by efforts to vomit. This, as already mentioned, is usually the result of a pleuritic accumulation making its way into a bronchus.

The expectoration of a consumptive, placed in water, will often separate into three or four strata, showing a difference in the elements of the matters.

The significance of spitting of blood or a more severe hemorrhage is important to be studied. Hæmoptysis is a frequent symptom of phthisis, though it may be caused by other diseases of the lungs, and by affections of the heart.

It may occur where no organic alteration can be proved. As a rule, when not traceable to other causes, it is dependent upon tuberculosis. As already stated, it may be the first striking symptom to be followed by a full development of the disease, but it is by no means always followed by an advance. Often marked relief is produced by such bleeding, and sometimes the disease remains stationary for a long time, or even recedes. It may advance a while and then recede, and recovery take place; or the disease may progress more rapidly than before the hemorrhage. In young girls bleeding from the lungs is less unfavorable, and when occurring in connection with menstruation, or vicarious of that function, its significance is much less serious. When taking place in girls there may be a complete and permanent arrest of the morbid tendency; but in other cases, on marriage and pregnancy and their results, the disease of the lung returns, and is fatal during confinement or soon after.

In about two thirds of the cases after hemorrhage, though the disease may be checked it still progresses, perhaps with the occasional recurrence of slight spittings or more severe bleedings; and rarely the hemorrhages are profuse at a comparatively early period, and seem to hasten on rapidly the fatal result. Diapedesis can, as a rule, produce only small quantities of blood, and when the quantity is large, some form of structural lesion must have occurred.

Niemeyer's view, that hemorrhage is a cause of phthisis, is not conclusively proven; and Lebert regards it as entirely without a clinical or anatomical basis.

In estimating the significance of spitting of blood, the possibility of its coming from other sources than the lungs must be considered.

Hæmoptysis occurs in from 50 to 60 per cent. of cases in phthisis in adults, but in children much less. When a general hemorrhagic tendency exists, the significance of pulmonary bleeding is different. It does not as certainly indicate tubercular disease.

In the early stage of cavities hemorrhage is not frequent; in the later it may occur and be terminal; but it appears only in a decided minority of cases, even in the latter stages of the disease.

Lebert makes three forms of hæmoptysis, viz.: 1. Diapedesis.
2. Acute vascular erosions; and 3. passive erosions.

It will be remembered that aneurismal conditions of the arteries in cavities often lead to the erosions.

On the whole, then, hemorrhage is comparatively favorable in a certain number of cases, and the improvement in some is permanent; but it is often only temporary, while in other cases there is not even temporary abatement. In rare cases an early hemorrhage materially hastens the fatal result. A case of this latter kind has very lately been under my care in the person of a medical student. Hemorrhages were frequently repeated and were quite free, the tuberculous developments were rapid, and in a few weeks death resulted.

Pains in the chest are very variable. They are present more or less in a majority of cases in the early stage. They are sometimes in the shoulders, in one side, or shooting through the chest; but as the disease advances they often cease, and are seldom severe and persistent unless there are complications, such as pleurisy or neuralgia. Reflex pains in the chest often cause more fear in patients free from tuberculosis than the pains experienced by those who are suffering from phthisis. In some cases of phthisis, from the beginning to the end, pain is entirely absent.

Other symptoms have their particular significance, but they were perhaps sufficiently pointed out in the general sketch of the disease.

ETIOLOGY.—SPECIAL CAUSES OF CONSUMPTION.

The causes of consumption may be divided into those which act locally upon the lungs, and those which act generally upon the system at large; but frequently the same cause acts both locally and generally.

It is doubtful whether causes producing a strictly local effect can of themselves result in tuberculous phthisis, without there exists in the system a peculiar condition disposing it to the affection, unless the doctrine of the germinal origin of the disease be true, and then local inoculation or infection may be admitted as capable of producing the disease in persons not disposed to it.

There can be no doubt that diseases of the respiratory organs, such as bronchitis, pleurisy, or pneumonia, when those diseases are produced by local causes, are followed not unfrequently by phthisis, and that these affections sustain a certain causative relation to the disease. The colliers', grinders', and polishers' phthisis are illustrations of the effects of local causes. Such causes not unfrequently produce the disease in persons whose antecedents afford no grounds for suspicion of a tuberculous tendency. But still such a tendency may have existed. However it may be with strictly local causes, those operating on the general

system, combined with local irritation of the respiratory organs, certainly seem capable of producing the disease in previously healthy persons free from any special predisposition to it. The readiness with which tuberculosis can be produced in healthy animals, such as rabbits, guinea-pigs, monkeys, etc., by local injuries combined with unfavorable hygienic conditions, renders it exceedingly probable that human subjects, however healthy and free from any taint, may have the disease produced by similar causes. It is true that when several persons are subjected to the same conditions and influences, some will have the disease while others will escape; but this only proves the existence of different degrees in the powers of resistance of these as of other morbid agencies. The same exposure will produce a fever or an inflammation in some and not in others, without there being a special tendency in any to such fever or inflammation.

That, however, there are special tendencies to the disease, constitutional and hereditary, there can be no doubt.

The subject of *heredity* is one of great interest in its relations to consumption as well as to other physical, mental, and moral conditions.

“Heredity is that biological law by which all beings endowed with life tend to repeat themselves in their descendants.”

Man in his organism and his dynamism—in his structure and his powers—in his physical and his mental life—is to a very large extent a resultant of ancestral influences. Every permanent condition or tendency of the organism, and even, though to a more limited extent, its temporary states, are capable of transmission to offspring. Habits, dispositions, and tendencies of body or mind are transmissible; but that does not prevent their being acquired, and in any given case the question as to whether a quality is hereditary or acquired is to be determined by observation in numbers of similar instances. The influence of heredity in the production of consumption has no doubt by some been exaggerated, while by others it may have been underestimated. There can be no question that the children of consumptive parents, or of grandparents and great-grandparents, to the third and fourth generations, are more liable to have consumption than those who have an ancestry free from the disease; but it is often produced in those whose ancestors have had no such taint. All agencies which lower vitality—previous diseases of most kinds, and bad hygienic influences, operating either upon the individual or his ancestry—tend to the production of the disease.

Some families have a peculiarity of constitution inclining them to phthisis, whose parents are free from that affection, but who may have some other defect. The children of intemperate parents are more

likely to have nervous diseases, but they are also more likely to have consumption. Family predispositions to the disease undoubtedly exist; but it must be borne in mind that the members of the same family are usually subjected to the same external conditions—they are in the same locality and habitation, have the same food and many of the same habits—and these influences may have as much, or more, to do in determining the result, where members of the same family have the disease, than the predisposition.

Residence on a moist soil, in a damp, dark, and unwholesome house, may give the appearance of a family predisposition where it does not exist.

Marriage of blood relations is particularly objectionable where any defects or morbid tendencies exist among them; as such defects or tendencies are intensified, often wonderfully exaggerated, and are almost certain to be perpetuated.

Where there is a consumptive tendency in both parents, though they are not relations, the offspring are doubly liable to the disease; and where cousins, or those of more remote relationship, who are consumptive, marry, their offspring are very sure to be affected.

As in other cases of hereditary transmission, one or two generations may be passed over, and the tendency to the disease appear in great force in the grandchildren or great-grandchildren of consumptives, while their immediate offspring may escape.

The question of the *communicability of consumption* as a specific contagion like syphilis has long been discussed, and very much of late years, but it is not yet settled. Some facts, such as the death of a husband or wife, followed by the disease in the other, not unfrequently witnessed, seem to indicate contagion; but such cases are capable of other explanations, and the vastly larger number who have been in close relations with consumptives without having the disease—the common escape of nurses in consumptive hospitals, etc.—oppose the notion of such communicability.

The experiments of inoculating animals with tuberculous matter at first seemed to prove specific contagion; but it was soon found that inoculations with other forms of organic matter produced similar effects; so that the question, if not settled negatively, is still an open one, with advocates of high authority on either side.

Free ventilation of the consumptive's sick-room, great cleanliness, and all proper precautions are important where there is even a remote possibility of contagion; but with such precautions the danger is certainly not so great as to justify any neglect of such attentions and care as are called for by the claims of humanity or affection.

Age has an influence in causation. Consumption may occur at

any age, but is most frequent from about twenty to thirty. When there is a tendency to tubercle, it is usually developed before old age; yet beginning earlier it may not culminate until there is failure of resisting power in advanced life. Senile consumption is a recognized form of the disease.

The influence of *Climate* and *Locality* in the production of phthisis is worthy of careful consideration.

Among the causes of the disease not inherent in the organism, climate and locality occupy a high place. The general subject of climate, in all its relations to the occurrence of consumption, is too extensive and complex to be entered upon in detail in this place; and only some general statements will be attempted.

The conditions of climate as to moisture and dryness have perhaps most effect.

The moisture of a locality may arise from a general climatic cause affecting a large region, or from one strictly local, as a damp, undrained soil on which the habitation is situated. Both of these conditions produce decided effects; but Dr. Bowditch's investigations in Massachusetts seem to show that the local conditions of an undrained, clayey, and springy soil are more efficient than the general moisture in producing the disease. The emanations from earth saturated with standing water seem capable of producing the most decided effects. These investigations show that one family after another, having no relation to each other except in their residence, has been carried off with consumption in particular damp localities; while in other places, not far distant, subjected to the same general climatic influences, but where the soil was porous or well drained and dry, the disease had not in the same manner occurred.

A combination of heat, moisture, deficiency of sunlight, and a low altitude, produces the greatest amount of this disease. In the West Indies there is a greater amount of consumption than in Norway.

A climate which is dry, cool, or even cold, especially if elevated, is favorable. Much, however, depends upon changes of temperature and upon winds and other conditions not readily understood or capable of exact estimation.

There can be no doubt that, as a general fact, there is much less consumption in high elevations, in mountainous regions, or on high plains, than in low situations, and, as a rule, there is more near the sea-shore than in far inland situations.

In our own country, though the relative number of deaths from consumption and other diseases appears to be greater in the Northern than in the Southern States, yet the absolute number of deaths from consumption among a given number of inhabitants is greater in the

South than the North. This is shown by the statistics, and is confirmed by the reports of the U. S. Army of the number of cases of consumption among the troops stationed in the North and the South.

The Lake Superior and Minnesota regions, though having less consumption than many other situations, are by no means exempt from this general scourge. The disease not unfrequently originates there among their fixed and native inhabitants.

New Mexico and Colorado, and other dry and elevated situations are thought to have much less of the disease than the average of the country ; but new countries have generally much less consumption than the old, and when these situations become more densely populated, and have been much longer occupied, the difference between them and the rest of the country may be found not to be as great. Still, in the elevated situations in Switzerland and other European countries, which have been long inhabited, and where the people are crowded together in compact villages, consumption is much less frequent than in most other places.

A rare atmosphere expands the air vesicles and increases the capacity of the lungs, and the purity and stimulating qualities of mountain air tend to invigoration, or at least by some means tend to the prevention of the disease.

Want of sunlight, whether from the climate—the prevalence of cloudiness and the color of the soil—or from the artificial exclusion of light from dwellings, is a marked cause of tuberculous disease. Animals—rabbits and guinea-pigs—kept in the dark very readily become tuberculous ; and the inhabitants of closes and cellars are specially liable to the disease.

The conclusions drawn from U. S. Army statistics by Dr. Coolidge, years ago, of the effects of climate on consumption, are :

1. That mere temperature has but little effect on the production of consumption.
2. That dryness is the most important atmospheric condition.
3. Next to dryness is equable temperature.

Comparatively uniform temperature for long periods, not disturbed by sudden changes, is more favorable ; but uniform *low* temperature is much preferable to uniform *high* temperature. A uniform high temperature for a long period, combined with a high dew-point, is worst of all.

Indoor occupations, with a deficiency of pure, fresh, open air ; deficient elimination the result of deficient air and a want of muscular exercise ; cramped positions of the chest ; the inhalation of dust, and the want of good food and proper digestion, all contribute to the production of phthisis. The *avoidance of fat* in the food is thought to be

injurious, as it is found that many consumptives have long had an aversion to fatty aliments.

Hard and constant study, with the confinement it involves, is depressing to the vital energies and favors this distrophy; and all *depressing emotions and passions* and *excesses* of every kind tend to the same result.

Insufficient or excessive clothing, or garments *improperly distributed* or applied too tight, may be decidedly injurious.

Diseases of the stomach and bowels, leading to imperfect nutrition and general depression, are not unfrequent causes.

The conditions of the skin—its proper sensibility and activity—are matters of much interest and importance, and have been too much overlooked. The skin is an eliminating organ, discharging effete matters and purifying the blood. Absorption takes place through its pores, and it performs a sort of respiratory function. It is an important source of sensation and reflex action—a source of marked and extended sympathies with the rest of the system.

The conditions of its circulation, secretion, and sensibility, cause great differences in the various organs and functions of the body. This is illustrated by exposure to drafts of air, by wetting the feet, and by the suppression of the cutaneous secretion, as causes and aggravations of various diseases.

The recent experiments of Dr. Brown-Séquard, with applications of chloroform to the cutaneous surface of animals, illustrate still further and more strikingly the importance of this organ as a source of reflex and sympathetic action.

Climate, exercise, clothing, cleanliness, and the amount of respiration all influence the conditions of the skin, and produce much of their general effects through the agency of this organ. The climate affects the skin by moisture, temperature, uniformity or variableness, and by winds and light. Humidity diminishes evaporation, and when continued it materially diminishes transpiration. In cold weather dampness impresses unfavorably the sensibility and reflex actions through the skin. Transpiration is several times as great in dry air as in air saturated with moisture. Winds, especially if mild in temperature and dry, increase transpiration, and at the same time induce freer respiration. Large-sized apartments favor both transpiration and a freer respiration; and mountains and an open country tend to induce free exercise, free respiration, and through these a freer action of the skin.

Some observations respecting the size of apartments seem to prove that a man who has less than 500 cubic feet of air space in which he habitually remains, is four times as likely to have consumption as one

who has over 600 feet, and is less constantly confined to it. Dr. Guy's statistics among London printers tend to show this.

Muscular exercise has much effect upon the action of the skin and upon the renewing of the tissues.

There is much difference as to the occurrence of consumption between compositors and pressmen—between those who stand at the case and handle type, and those who work actively at the press—though all are in the same room. Something may be due to the original physical condition of the men selecting these employments—the weaker may select the type-setting, and the stronger the press-work—but much is doubtless due to the muscular exercise which the one class has and the other has not.

It is true that muscular labor largely promotes waste, but it still more largely promotes transpiration, purification, and renewal.

The practice of regular bathing and frictions, keeping the skin active, has a marked influence upon various functions, tends to the production of internal as well as external purity, and when properly managed protects the system to some extent from the injurious effects of dampness and sudden changes.

While climate, including altitude, exerts a vast influence upon all conditions of the system—upon transpiration, respiration, digestion, secretion, and innervation, and through these upon the occurrence of phthisis—*occupations* also, especially whether indoor or outdoor, have a vast effect upon the production of this disease. All statistics show that those whose occupations take them much in the open air have far less of phthisis than those whose business keeps them indoors, especially in small apartments.

According to Lombard, of Geneva, whose investigations on these subjects entitle his opinions to great respect, of moulders who inhale much dust, 145 in 1,000 have consumption. Of sedentary workers in close rooms, 140 in 1,000. Workers in a dry and artificial warm atmosphere, 128 in 1,000. Workers in the open air, 80 in 1,000. Of professors that speak much, 79 in 1,000 have consumption; while of professors who exercise much in open though humid air, only 39 in 1,000 have the disease.

The external conditions most tending to induce consumption are a low, moist, hot climate, poor food, with filth and lazy inaction within doors.

The *intermingling of races* that are so much varied from each other as to be almost specifically different, approaches to the conditions of hybridity, and tends ultimately to a lowered vitality and the production of phthisis. The first cross between the Caucasian and the African often results in a vigorous progeny, but the subsequent gener-

ations are likely to deteriorate. The offspring of mulattoes are very often feeble and phthisical, and nature protests against the amalgamation. The same principle holds in reference to the intermingling of the white and the American Indian races, and also of the African and Indian. The sudden transition from the freedom and habits of savage life to the confinement and customs, often accompanied by the vices and bad hygienic conditions of an imperfect civilization, strongly tends to the production of this affection.

This has its analogy in the confinement and domestication of wild animals. Phthisis is well known to be the pest of menageries and zoological gardens, while the animals in their wild state are comparatively if not absolutely free from it. These facts, as regards both men and animals, illustrate the frequently *acquired* character of phthisis, independent of hereditary influences.

An impression seems to have obtained a footing in this country that the *use of alcohol*, even in excessive quantities, tends to prevent consumption. The origin of this opinion it is not easy to discover. It was not imported from Europe, for, so far as I have been able to ascertain, it is not held there by any respectable authority. It is not sustained by any authenticated statistics with which I am acquainted. All the statistical observations that to my knowledge have been attempted in this country—those of Dr. Bell, of Brooklyn, N. Y., and of Dr. Davis, of Chicago, and others—point decidedly in the other direction. Lebert emphatically states that the free use of alcohol is a *cause* of consumption; and Williams, Chambers, Peacock, Aitken, and other authorities in England, appear to concur in this view. It is generally held that alcoholism is a frequent cause of the fibroid form of the disease. It certainly induces a lower vitality, produces fatty and other forms of degeneration, and it would be rational to infer that it promotes rather than prevents the degenerative changes of phthisis. This inference seems sustained by facts.

The two most frequent serious diseases in the British army stationed at home are *phthisis* and *delirium tremens*.

The general habit of free indulgence in alcohol among British soldiers, when not in foreign service where the supply is limited and controlled, but when at home in barracks where restraint seems impracticable, is well known; and according to Dr. H. C. Lombard, in his authoritative "Treatise on Medical Climatology," forty-six per cent. of the deaths in the English army in garrison is from phthisis. Until a large number of authentic statistical facts can be presented to offset these, it seems absurd to hold that alcoholism prevents consumption.

The suggestion that "the infrequency with which the disease is

found in post-mortem examinations of those who have died from intemperance has led to the supposition that the use of alcohol antagonizes the tuberculous cachexia" (Flint's "Practice of Med.," 5th ed., p. 207), is loose and conjectural, not founded upon large numbers of scientifically observed and recorded facts from different sources, and apparently not confided in by the distinguished author himself. He adds: "Assuming there is ground for this supposition," etc. To sustain the doctrine of the prophylactic power of alcoholism, the statement of Leudet is quoted, that of 121 persons addicted to the use of alcohol 20 were tuberculous; while among 600 tuberculous patients he observed, these 20 were the only intemperate persons. The proportion of intemperate and temperate persons in the community where these observations were made is not stated; and certainly 20 tuberculous cases in 121 persons, or 16.5 per cent., is a very large proportion of consumptives compared with the numbers not consumptive in any community. If every 121 intemperate persons have among them 20 tuberculous consumptives, as these statistics tend to show, the preventive power of alcoholism over tuberculosis must be regarded as a mathematical *minus* quantity, for in no community that I have ever heard of are 16.5 per cent. of the people consumptives. These statistics would indicate that alcoholism was a cause rather than a preventive of tuberculosis.

To compare the number of intemperate persons having phthisis with the temperate having the disease, without showing the comparative numbers of the intemperate and temperate in the community, and without showing what proportion of the temperate people have consumption, must be seen to prove nothing as to the antagonism of drunkenness and tuberculosis. If statistics had shown that much more than 16.5 per cent. of temperate persons had the disease, while only that percentage of drunkards had it, they would indicate what by implication is claimed for these. But what temperate community ever had 16.5 per cent. of its people affected with tubercular phthisis?

Dr. R. E. Thompson, Senior Assistant Physician and Pathologist to Brompton Hospital for Consumptives, whose position gives him large opportunities for observation, says: "Alcoholic intemperance has a very distinct effect upon the condition not only of the body generally, but also especially of the lungs." Free beer-drinkers, he says, have a hydropic degeneration of the tissues and a tendency to hemorrhage. "The lungs are found in a condition of general vascular congestion and hyperæmia, and the traces of previous hemorrhages are to be seen in old caseous patches in the midst of pigmental and more or less thickened lung tissue. When such lungs break down, the secretion is likely to be profuse and the destruction rapid." After

describing the morbid conditions of other organs, he says: "The sputa are, as a rule, in these cases sanguinolent, and the *tubercle* that is subsequently formed is invariably pigmented." Spirit-drinking, he says, causes a hardened fibrotic condition of all the tissues and organs, "and the lung is included in the list of altered organs. It becomes hard and fibrotic; if cavities form, they are not larger than a nut, and scattered around the periphery; between them the tissue is firm and hard, and of a fibroid character. If tubercle results, it occurs in very close, compact, but large masses, sometimes assuming the form of bands traversing the lung." He then gives the physical signs of "alcoholic fibrosis." (Physical Examination of the Chest, London, 1879.)

From an account given me by an intelligent California physician of the frequency of a form of phthisis among the free drinkers of the wines of his State, it appears to resemble this consumption of beer-drinkers more than that of the spirit-drinkers.

Dr. Peacock, of Victoria Park Hospital for Consumptives, in London, when told of the American notion of the prophylactic power of alcohol, and when asked whether he thought it a preventive of phthisis, replied that, so far from it, it was a fruitful cause of certain forms of the disease.

The statistics of Dr. N. S. Davis, of Chicago, before referred to, were published in the Transactions of the American Medical Association for 1860.

There is a record given of 210 cases, which for a few years previous had occurred in his practice, both hospital and private. These were divided into three classes—the first, such as had used some form of alcoholic beverage almost daily from one to twelve years previous to the active signs of tuberculosis; the second embraced such as drank occasionally; and the third such as had abstained from their use. Of these cases 68 belonged to the first class, and had used alcohol freely; 91 to the second—occasional drinkers—and 51 were abstainers. Fifteen of the first class were decided drunkards, and five were admitted with *delirium tremens*. This shows that free drinkers are not exempt from the disease, and that about one third of all the cases seen were in free drinkers. In order to determine more positively the influence of the alcohol in the production or prevention of the disease it would be necessary to know what proportion of the people from which his patients were taken were free drinkers, occasional drinkers, and abstainers; and it can hardly be supposed that in Chicago and vicinity one third of the persons, men and women included, are thus free and constant drinkers.

Dr. Davis' conclusions are worthy of notice, and are as follows:

“1. That the development of tubercular diseases is facilitated by all those agents and influences, whether climatic or hygienic, which directly or indirectly impair or retard the metamorphosis of organized structures, and the efficiency of the excretory functions.

“2. That observations and carefully devised experiments both show that the presence of alcohol in the human system, notwithstanding its temporary exhilaration of the cerebral functions (?), positively retards both metamorphosis and elimination.

“3. That neither the action of alcoholic stimulants on the functions of the human body, nor the actual results of experience furnish any evidence that these stimulants are capable of either preventing or retarding the development of tubercular phthisis.”

Neither these statistics nor inferences are given as conclusive proofs of the precise influence which alcohol exerts in the etiology of consumption, but they certainly no more favor the idea of its prophylactic virtues than the other facts referred to. It is to me a matter of astonishment that a writer generally so careful in his statements and so correct in his conclusions as Dr. Flint, should, on so slight grounds, in a matter of so much importance, express opinions so opposed to what might reasonably be supposed to be the effects on consumption of an article which, in excessive quantities, is well known to produce such degenerative and devitalizing results.

This subject is too important, as a mere medical question, to allow what I believe to be the *false* impression of the antagonism of alcoholism and phthisis to pass without a rigid examination, and if disproved, without an emphatic contradiction. Besides, its bearings upon the general subject of intemperance and morals, as Dr. Flint admits, should not be overlooked. Too many persons have been made drunkards from the notion that whisky prevents consumption to make this view of it a matter of indifference to the conscientious practitioner.

The importance of studying the causes of a disease so common in its occurrence, and so fatal in its course, in reference to its prevention, is obvious.

DIAGNOSIS.

Rational Symptoms.—The diagnosis of consumption is to be made by observing carefully the phenomena which have been described. When far advanced, it is for the most part easily distinguished; but in the early stages, when the diagnosis is most important to be made, it is more difficult. The early symptoms require to be carefully studied. When seen at a later period, the mode of attack and these earliest symptoms must be inquired into. The family med-

ical history will often aid, but that of the individual is more important. It should embrace his residence and occupation, his previous diseases, and all the hygienic influences to which he has been subjected. The frequency of cases in which the disease is acquired should teach us not to rely too much upon the absence of a consumptive family history in excluding the disease, or on the presence of such history in admitting it.

A patient with a protracted cough, with an early history of bronchial catarrh, may have only catarrh still; but the disease may have extended and there may be phthisis.

The same may be the case with chronic pneumonia or chronic pleurisy. A cough without preceding catarrh, dry and hacking from the beginning, renders the presence of tubercles probable.

Hæmoptysis, when unprovoked by violent exertion or injury, and not dependent upon diseases of the heart, or upon hemorrhagic diathesis, and when it is unconnected with menstruation, is very suspicious. Still, as already stated, it is by no means always followed by phthisis.

If a cough comes on at first dry, but not merely nervous or sympathetic with disease of some other organ, if mucilaginous sputa then appear, and afterward a yellow, muco-purulent matter, especially if this contains rounded masses, the suspicion will be increased. If the temperature is decidedly elevated, the pulse much increased in frequency, the skin smooth and loose, and if there is a delicate flush mingled with paleness, progressive emaciation, increasing shortness of breath markedly perceptible on exertion, with occasional attacks of pleurisy, local pneumonia, or local bronchitis, especially confined to the upper part of the lungs; and if, in addition to these symptoms, a distinct hectic appears, with its peculiar flush, irregular distribution of heat, and with its chills in the forenoon and sweats at night, consumption may be clearly presumed. Indeed, all these symptoms taken together, or a large part of them, with an experienced and close observer, will be nearly conclusive of the disease if other local affections are excluded. A peculiar hoarseness is sometimes quite characteristic, and will confirm the impression the other phenomena have made.

If tubercles are discovered in any part of the body of an adult, there is always strong suspicion of their existence in the lungs.

The observance of the temperature, as a means of diagnosis in consumption, is of considerable value. The different varieties of the disease differ in the range of the temperature; but, according to Dr. Sidney Ringer, there is an elevation of temperature in all cases of tubercular deposit, though Wunderlich says there are intervals free from fever in some cases of phthisis. The fact seems to be, certainly

as a very general rule, that when tuberculous disease is progressing, especially when softening is taking place and destructive changes are occurring, the temperature is elevated, though not alike in all cases, where equal progress is being made, and often there are decided fluctuations and remissions. Charcot says: "In the absence of local symptoms, the thermometer alone can detect pulmonary consumption in old people."

Sir William Jenner, and he is followed by Finlayson, makes three clinical types of the disease, in reference especially to temperature, viz., the Insidious, the Active Febrile, and the Adynamic.

In the *first type*, the morning temperature is normal, or even sometimes below; while the evening is more or less elevated. A difference of 1° , or 1.5° F. to 2.5° F., occurs between morning and evening.

In the *second type* the morning and evening temperatures are both high, though there are evening exacerbations. As an example, there may be a morning temperature of 100° F. or more, and an evening of 101.5° to 103.67° F.

In the *third type* the morning and evening temperatures are likewise both high, but there is a tendency to exacerbations at irregular times. On one day there is a morning temperature of 102° F., and an evening of 102.53° F., while on another day the morning and evening heat may be respectively 102.6° and 104° F. These figures are given for young persons, but with slight changes they apply to those that are older.

In acute rapid cases the temperature is from 100.5° to 104° F., with moderate variations between morning and evening.

In slow consumption there are great variations of temperature in different cases, and in the same case at different times, dependent upon the extent of the disease, its stage, and the rapidity of its progress. It fluctuates from the normal, and even below, to 105° F. at times.

It is rather the persistence and course than the height of the temperature that must be consulted in consumption.

In great impairment of digestion and assimilation, after hemorrhages and from the exhaustion of diarrhœa, the temperature may at times, and especially toward the last, fall below the normal; while in other galloping cases hyperpyrexia may continue to the end.

It is usually higher than in health even during the prodroma, and elevation of temperature may be among the first evidences of the existence of the disease. In connection with the temperature, the frequency of the pulse and respiration must not be overlooked.

In reviewing the diagnostic symptoms, independent of the physical

signs, the following points, very judiciously presented by Dr. Flint,* should be borne in mind: “(a) Cough and expectoration, not succeeding an attack of acute bronchitis and not connected with chronic pharyngitis; the cough at first dry, and afterward an expectoration, at first small and transparent, and becoming gradually more abundant and opaque. (b) Stitch-pains at the summit, not connected with intercostal neuralgia. (c) Chills not referable to malaria. (d) Hæmoptysis. (e) Accelerated breathing. (f) Loss of weight. (g) Pallor or anæmia not otherwise explicable. (h) Hoarseness or huskiness of voice, proceeding from chronic laryngitis. (i) Chronic peritonitis not traumatic [or alcoholic]. (j) Suppression of menses. (k) Buoyancy of mind, instead of despondency.”

Physical Signs.—But the diagnosis is more positively determined by adding to the rational symptoms the physical signs.

These differ in the different anatomical stages and the different varieties of the disease. They will depend much in each of the stages and forms upon the localization, limitation, or diffusion of the disease in the lungs. The morbid signs peculiar to the disease are caused by the consolidation, the softening, and the cavities formed; and these are supplemented by those of the inflammatory processes so often accompanying these states.

Thus consolidation causes dullness on percussion, bronchial respiration and deficient vesicular murmur. Local bronchitis will produce the various râles belonging to that state; and the local pneumonias and pleurisies will be accompanied by the signs belonging respectively to each. When the preceding symptoms have continued for a length of time, and a pneumonic crepitation, a pleuritic friction sound, or subcrepitant or bronchial râles are heard in the upper part or in various other parts of the chest, the indications of phthisis are too strong to be doubted.

In the condition of induration there is often shrinking of the lung, and decrease in the fullness of the chest in the part affected; and cavities, when present and of considerable size, often furnish other signs.

A more systematic description of the physical signs is required.

Though the different stages of phthisis run into each other and are not strictly defined, they may be practically recognized, and certain signs more particularly belong to each.

In the *First Stage*, on *Inspection* the statical condition—the size and shape of the chest—is usually not materially altered. When consolidation is considerable and confined to one apex, there may be slight

* *Prac. Med.*, 5th ed., pp. 209, 210.

flattening or depression. But some cells may be distended while others are closed and contracted, and thus by compensation the size of the part may be preserved.

The motion of the affected part is less, varying with the amount of the disease. This may be so slight as to be imperceptible. The change is often first at the very apex, and by looking across the shoulders horizontally the diminished motion may be earlier and more distinctly perceived.

Palpation may discover the diminished motion when the eye does not. Deficient expansion will often be discovered in the infraclavicular region. Here the hand may detect elevation of the ribs without the expansion or arching, showing that a less quantity of air enters that part of the lung. With a full inspiration the difference in motion between the diseased and well side will be more marked. This sign is more valuable in women than in men, as they normally expand the upper part of the lungs more in respiration.

The vocal fremitus is usually slightly increased, but this sign is variable and not altogether reliable.

Percussion in this earlier stage is usually moderately dull, but it may not be sufficiently marked to be significant. If there be deposits mingled with collapsed vesicles, the percussion will be decidedly dull, with a change of the pitch more marked than other qualities of the sound. If, however, there be commingled emphysema of a considerable portion of the alveoli instead of their collapse, which is possible, the percussion note may not be much changed. When the sound is dull and the note high pitched, the resistance felt may be perceptibly increased. These signs are more positive and valuable when manifested on the left side than the right, as normally there is apt to be more resonance and a lower pitch on the left side; and they are all more valuable in women than in men, as normally the percussion note is more pulmonal in them in the upper part of the chest. In this stage, however, the resonance is but moderately diminished; it may be hard and wooden, increased in loudness, though of a higher pitch. The change in pitch and in the peculiar quality of the sound is more important than changes in the loudness or resonance. When the deposit is deep in the lung, and covered by an emphysematous layer, the percussion signs may be neutralized. If emphysema be present on the other side of the chest, as comparisons of the two sides must always be made, mistakes may occur. The duller side may be normal, while the more resonant side is morbidly expanded. By percussing the suspected side from above downward, comparing the subclavicular region with the mammary or lower axillary, the error may be detected. The subclavicular region, if healthy, should

be quite as resonant, as the part below. It is well to use percussion during full inspiration and full expiration, and to observe the difference.

The *Auscultation signs* are more important than the percussion, and are next to be noticed.

Though the percussion signs may be annulled by mingled emphysema, the auscultation signs will not be. These will vary—there is little that is fixed and absolute—but there will not be the soft, full, breezy, uniform, respiratory murmur of health, with the normal comparative length of the inspiratory and expiratory sounds. A deviation from the normal may be observed by the inexperienced when it is not analyzed or defined.

In ordinary cases of deposits in the *first stage*, the intensity of the respiratory murmur is generally weakened. It may be almost suppressed in some points, and is often exaggerated in others. The rhythm is apt to be perverted, though this is by no means always so, not, indeed, in a large proportion of instances. The jerking in the respiration is usually synchronous with the impulse of the heart, and is caused by it; but if observed more upon the right side than the left, there is some change in the elasticity and conducting power of the lung intervening between the walls of the chest and the heart. When, then, this irregularity is not the result of unusual force of the heart's action, is confined to the suspected region, and is not dependent upon a general cause, upon irregular action of the muscles of respiration, and is noticed at a greater distance from the heart in one direction than another, it is indicative of a stiffened or solidified condition, and usually of deposits. However, this jerking or cog-wheel respiration is not positive in its significance, and is not so much to be relied upon as changes in other properties of the breath sounds. These sounds, when there are moderate deposits, are harsh and slightly blowing; and the expiratory sound is increased in its proportion to the inspiratory. There is *prolonged* expiration, and the pitch of this sound is higher, and its quality much harsher and more blowing than the inspiratory. If, however, the prolonged expiration is not altered in quality—is simply increased and prolonged without its pitch or its harshness being affected—it is not positively significant, especially when thus heard on the right side. These signs are more significant if more limited and circumscribed. If they are marked and decided above the second intercostal space, and absent below, they are quite significant. Localized bronchial or subcrepitant râles are sometimes heard at this stage, and, as before stated, denote a local bronchitis, which, if confined to the top of the lung, is indicative of the presence of deposits exciting the inflammation. Crepitant râles heard in

the same situation are indicative of a pneumonia produced by the same local cause.

Dry crackling is often developed during the latter part of this stage of deposit before softening is fully manifest ; and when softening occurs a moist crackling is often heard.

The vocal sounds vary too much to be reliable in this stage ; but bronchophony is not unfrequently heard.

If the heart sounds are more audible on the right than on the left side, showing that the right lung is a better conductor of sounds, it indicates a greater or less degree of consolidation of that lung. A subclavian artery murmur loudly heard on the suspected side has some value as indicating a better conducting medium through a more solid lung ; but the situation of the artery and the action of the heart may have an influence upon the sound without there being a change in the lung.

If signs of plastic pleurisy appear at the seat of the other signs, they indicate that the morbid process has extended to that surface, and add their confirmation to the diagnosis.

If these signs or a large portion of them are present, the diagnosis must be regarded as positive, or sufficiently so to justify a decided expression of opinion, should such be called for.

In the *Second Stage*, or that of softening, the signs are partly the same as those described, though generally exaggerated, but some new ones are added. As the tubercles or exudate soften there will often be heard the *humid crackling* before mentioned, and thin metallic bubbling and moist clicks are sometimes audible. These are far from being constant ; but by repeated listenings in most cases they will be revealed. Soon after such softening, and not unfrequently before, small cavities form from dilatation of bronchi ; and they may or may not be detectable, and when presumptively detected it will be by more blowing sounds, coarser bubbling, or a different tone of the percussion note.

Now the lung becomes contracted at the diseased point, and the whole size of the lungs and heart becomes less, as the quantity of blood in the system diminishes. The diaphragm is raised, the heart is more uncovered by the contraction of the lung, and its space of dullness is increased, though its size is diminished. In some chronic cases, especially where fibroid productions and contractions take place, and where considerable vigor of the system continues, the right heart, from the increased labor required to carry on the circulation through the lungs, becomes hypertrophied, notwithstanding the general wasting of the system.

In the *Third Stage*, or that of more decided ulceration and excava-

tion, there is often more depression still, though sometimes increased deposits compensate for the waste ; and when large cavities form, they may be expanded with air or be filled with fluid so as to cause actual bulging. In such case, where the walls of the cavities are flaccid and expansible, the air may pass in and out of them freely, and the mobility of the part be increased.

Deposits go on though cavities form, and many signs of the preceding stages continue and increase. In addition to them the special evidences of cavities may present themselves, though on the other hand cavities may be present without being detected. In order to be distinguished they must be near the surface, must be of considerable size—an inch or more in diameter—and must contain considerable air.

The rapidity of respiration is now increased, dyspnœa is generally felt, always on exertion ; and commonly the respiratory movements are more restricted. As before intimated, they may become freer by air passing into the cavities ; and if the cavity be large and empty, with smooth walls, amphoric respiration may be heard. If the air still passes in and out in the respiratory movements, when the fluid is above the opening of the bronchus gurgling sounds or hollow bubbling may be heard.

Cavernous sounds—hollow, hoarse, *low-pitched*, blowing, or amphoric—may also be heard, varying or disappearing according to the size and state of the cavities. Multilocular cavities seldom present any characteristic sounds, and are therefore frequently incapable of detection by auscultation. Trabeculæ, or bands running across a cavity, have the effect of partitions in the prevention of sounds. The same causes that produce variations in the percussion note make the auscultation sounds to differ. If healthy lung intervene between the cavity and the walls of the chest, a slight tap might bring out a normal sound, while a stronger one would detect the change.

Amphoric and cracked metal percussion sounds are sometimes heard.

The *vocal resonance* varies. It may be pectoriloquous, amphoric, bronchophonic, natural, weak, or absent. Whispering pectoriloquy is most characteristic of a cavity, but it may occur in other conditions—over large bronchi with much lung condensation—and it is so often absent as not to be relied on. Gurgling or splashing may rarely be produced by succussion, or by the heart's action, and metallic tinkling is just possible.

The contraction of a large cavity may draw the heart out of its proper place.

The evidences of cavities are sometimes clear and satisfactory,

sometimes presumptive, sometimes doubtful, and sometimes absent, when a *post-mortem* inspection will show their long existence.

Most of the symptoms and signs stated as belonging to phthisis may be present in other diseases, and a few words upon its *differential diagnosis* seems called for. There is, in fact, scarcely an individual symptom or sign which belongs exclusively to phthisis, or which may not possibly appear in other affections. It is not so much any few pathognomonic appearances as the combination of phenomena and the whole history of a case that must determine the diagnosis.

Incipient phthisis may be confounded with dyspepsia. There will be wasting in both, and a "stomach cough" in the latter may simulate a pulmonary cough. Atonic dyspepsia is generally without fever, while elevation of temperature is present more or less in phthisis, but the physical signs will determine the diagnosis.

Hectic fever may be confounded with intermittent malarial fever; but when hectic is present, the disease is usually advanced and the physical signs will, when present, be conclusive. At an early period, besides the difference in the chills, the fever, and especially the sweat, they will not be arrested in the same permanent manner by quinine as will the ague.

Not only may the rational symptoms resemble those of other diseases, but the physical signs of some other states may resemble those of consumption.

There may be depression, some dullness on percussion, and a feeble respiratory murmur after a pleurisy; and when the pleurisy has affected the upper lobe, and been followed by contraction of false membrane, the physical signs may strikingly resemble those of the earlier stage of tuberculosis.

In the case of a lady, the wife of a medical gentleman, whose health was suffering from some disease of the pelvic organs, the lungs were examined by two or three prominent physicians who expressed the confident opinion that tuberculous deposits had taken place in the upper part of the right lung. At the time she came under my observation, some weeks later, the prominence of the right clavicle, the diminished motion of the upper part of the right lung, and the diminution of the respiratory murmur were marked; the percussion resonance was diminished, but there was no prolongation of expiratory sound and the pitch was not changed; and an inquiry revealed the fact that some years before she had had an attack of acute pleurisy in that region which had been somewhat protracted, and that since then she thought the motion in that side was not as free as before. An opinion of the absence of tubercle was expressed, and death from cancer twelve years after, without evidence of pulmo-

nary disease in the meantime, proved the correctness of the conclusion.

There may in other cases be gurgling and amphoric respiration in a pleural abscess, or in a simple but largely dilated bronchus. Phthisical changes may be at the base of the lungs and resemble simple chronic pneumonia; and simple pneumonia may be at the apex and resemble consumption.

Tubercular deposits may be diffused, and not sufficiently concentrated at any one point to give marked signs. There may be both in the physical signs and rational symptoms a resemblance to bronchitis. But a bronchitis may be followed by extension of disease to the lungs, by tubercular deposits and phthisical wasting; and the transition may be so gradual as to produce, for a time at least, serious doubts with the most expert.

The early signs of phthisis may be obscured by a bronchitis. If signs of a bronchitis which has been general linger at the apex or in one lung when disappearing from other parts, the case is suspicious of phthisis.

Acute miliary tuberculosis may resemble typhoid fever in the rational symptoms; and in young children it may resemble atelectasis pulmonum in the physical signs.

A general pleurisy will obscure a case. An opinion as to tubercle may not be safely given while pleurisy exists.

A chronic pneumonia may be caused by a preceding deposit of tubercle, or it may be a cause of such deposit, and it may be very difficult to determine which had the precedence, or whether tubercles are present.

When one lung is destroyed while the other is in a healthy state, the presumption is that the disease is not tuberculous, or at least was not originally, as in an advanced stage of the disease tubercles are very seldom confined to one lung.

A single lung may be destroyed by pleurisy or pneumonia, these diseases being local; but tuberculosis is a more general affection, and although the deposit usually commences in a single lung, it sooner or later extends to the other, though it is often in a much less advanced stage in the lung last attacked.

To avoid errors from the different sources pointed out, and others that might be mentioned, the history must be obtained, and all the symptoms must be carefully observed and studied in connection with the signs; and the microscope in the search for tuberculous matter and fragments of disintegrated lungs, may be of essential service in determining the diagnosis in doubtful cases.

PROGNOSIS.

The prognosis of consumption, where the disease has made much progress, is well known to be very unfavorable ; but still there are occasional cases of recovery even after much advancement ; and by early and improved methods of treatment and the use of preventive measures, the mortality from the disease has materially diminished during the last twenty or thirty years.

As already intimated, there are various modes in which improvement takes place.

When changes occur in the general state of the system—when the tuberculous diathesis is removed—the deposit may be absorbed away, the primary tubercles may shrivel down into a horn-like or fibrous material and become obsolete ; or the softened caseous masses may have their organic materials absorbed while a calcareous substance remains and becomes incapsulated ; or the morbid mass may be expectorated, leaving a cavity behind, which may or may not cicatrize. There may be a suspension of diseased processes, and the patient, with more or less impairment of the lung, may enjoy indefinitely a fair state of health.

These favorable changes are sometimes the result of change of climate or occupation, sometimes are effected by hygienic and medical treatment, and sometimes they occur spontaneously without either change of climate or other hygienic conditions, and without medical treatment. In a certain but exceedingly small proportion of cases the disease is apparently self-limited and tends to recovery. In cases of phthisis, as in those of other diseases, but in this less frequently than in most others, the disposition to assume the original healthy type is sometimes successful ; and this disposition has to do in the recoveries apparently effected by climatic, hygienic, and other therapeutical measures.

The circumstances on which may be grounded an opinion of a tendency to recovery relate to the circulation, the heat, alimentation, and the ultimate nutrition of the patient. A slow or nearly natural pulse, a normal or nearly normal temperature, a good digestion and proper general nutrition, afford the basis of hope.

When the disease is limited to a small area, though usually resulting in a breaking down of the tissue involved, it is more rapid in its local progress through the different stages, yet it is more favorable to recovery than when more diffused. According to the observations of Dr. Flint, who has carefully studied this subject, neither age, sex, nor heredity has a perceptible influence upon the disposition to self-limitation.

In the foregoing account of the pathology, symptomatology, etiology, diagnosis, and prognosis of phthisis, more space has been occupied than was originally intended, and perhaps more than can well be afforded in a general work of this kind. It is, however, difficult to point out any part of the statements which is not necessary to a full understanding of the disease; and the frequency and severity of the affection must serve as an apology for the space occupied.

It is not forgotten that the great object of medical knowledge is the relief of suffering and the prolongation of life, and that a knowledge of the best methods of management for the prevention, relief, and cure of this affection should be sought for more eagerly than that of any other department of the subject.

TREATMENT OF CONSUMPTION.

The treatment of this disease may be divided into the *prophylactic*, *palliative*, and *curative*. Of these, the first is most important, the second is often very useful, and the third is occasionally effectual. The same general means, however, will often contribute to all these ends, and success in cure, though comparatively rare, has been sufficient to encourage the most painstaking and persistent efforts to that end.

The doctrine that tubercle is a specific neoplasm, allied to cancer in character and in hopelessness of its arrest, and that all cases of phthisis are primarily and essentially tuberculous, has for the most part given place to the doctrine of its inflammatory origin, at least in many cases, and to the acknowledgment of the great influence of inflammation over the course of the disease in nearly all.

The fact is, however, recognized, that the neoplastic growth, and the inflammation preceding, accompanying, or following it, occur in a condition of lowered vitality, very frequently arising from unfavorable hygienic conditions. It follows, then, that efforts should be made to improve those conditions, and that general supporting measures with the view of improving vital activities should be employed.

The reproach, not without foundation, which not long since rested upon a large portion of the profession, of giving much attention to pathology and diagnosis, to the neglect of therapeutics, is being removed.

To some of the European schools the charge still applies, and a skepticism which paralyzes all therapeutic investigations and efforts still exists; but it is passing away, and with many advancing men efforts at therapeutic effects are actively made, and positive methods of treatment are vigorously pursued. New remedies are being introduced, and old ones are revived. The antipyretic treatment of fevers

is an example ; and in consumption enterprising physicians are no longer willing to be mere spectators of the ravages of the disease. Efforts for this class of patients are being made, and frequently the physician has the satisfaction of relieving suffering, of prolonging life, and of effecting in quite a number of cases the temporary, and in some the permanent cure of his patients.

The natural course of the disease is more favorable than was formerly supposed, and a knowledge of this fact gives encouragement to efforts at relief, and an acquaintance with nature's methods of cure gives direction to the measures for its accomplishment by art. Such knowledge enables the physician to co-operate with the efforts of the system for the restoration of the physiological state.

The *prophylactic* treatment of phthisis is suggested by a knowledge of its causes, and consists in their avoidance ; and the general means of prevention for the most part tend to palliation and cure. They are, in fact, among the most useful measures in the management of the actual disease.

In an affection against which, when established, the powers of the system, aided by all the means at present known, so often struggle in vain, prevention should receive the first and most earnest attention, and the simple predisposition or diathesis should be vigorously opposed. All the antihygienic conditions which conduce to the disease should by every possibility be removed. "Hereditary predisposition in particular requires to be contended against energetically and unremittingly." (Lebert.) Where a special cause, such as syphilis, which tends to the production of the disease is present, it should be vigorously attacked. A chronic pleurisy, pneumonia, or bronchitis, or the debility of the system and morbid state of the lungs following some cases of typhoid fever or measles, should be remedied as speedily and completely as possible, and should receive special attention in persons predisposed to phthisis. So also with all other special causes. But except in cases where other diseases precede, the physician is seldom consulted until prophylaxis is no longer practicable. Phthisis is commonly first encountered in its more or less developed form ; and we are thus brought to consider its treatment as an actual disease.

As consumption is essentially a disease of degeneration and decay, or at least of a lowered vitality, the treatment must to a large extent be invigorating and sustaining. Good food, pure, dry air, with varied exercise, such as can be well borne, and as much as possible out of doors, the enlivening influence of bright sunshine, agreeable scenery, cheerful society and occupation, are among the means most efficient in restoring structures and functions prone to decay.

This is the first and most important view to be taken of the disease. We know of no specific, of no one remedy which directly and certainly counteracts the tuberculous condition, and restores health to the obstructed or degenerated tissues. Such a remedy may never be found; but we are not entitled to prejudge the future.

Among the important hygienic measures, the matter of diet is presented. It is easy to say that a good, digestible, nutritious diet should be taken; but it may not be so easy to determine what in quality and quantity in a given case is the most suitable and best. Lebert says: "In the matter of diet there is a double rock to be avoided, upon which our predecessors have often been stranded, the not giving sufficiently substantial nourishment, on the one hand; and the more common error of to-day, the prescribing of nutritious meats and generous wines in too great abundance." My observations long since convinced me of this latter danger, and the former is now universally conceded. More food than can be well digested, or than the system needs, tends to produce irritation and lowered formations; and a free quantity of alcohol, so far from counteracting the degenerative tendencies, much oftener tends to produce them. It will be remembered that in every form of phthisis, hyperplasia of connective tissue, fibroid productions and degenerations are likely to occur, and the influence of free quantities of alcohol upon such productions, from a pathological stand-point, is generally conceded to be bad. At any rate the beneficial effects of alcohol, either as a prophylactic or curative agent, are by no means established—its specific virtues in counteracting tubercle cannot for a moment be admitted; and its action upon consumptives is similar to that upon other people. That it may sometimes palliate certain symptoms, enable the patient to take more food when alimentation is low, and induce him to be more in the open air when inclined from depressing sensations to remain indoors, may be admitted; and its occasional and temporary effects may thus be useful; but beyond this there is no sufficient proof of its virtues; and it should be prescribed in consumption under the same restrictions as in other cases of disease.

Lebert, whose experience was very large, and among wine-drinking people, says: "Temperance in the use of fermented and alcoholic drinks is at least as necessary as moderation in the taking of food." He does not attribute any special therapeutical virtues to alcohol in consumption, either in large or small doses. His opinions as to its free use are founded on the experience not of himself alone, but on that of others as well, as he says: "Formerly in mountain sanatoria the use of wine was carried to excess, but this abuse has

since been corrected." He urges repeatedly the greatest moderation in the use of every form of alcoholic drink.

While an exclusive milk diet cannot be recommended, a diet consisting largely of this article is strongly to be commended to those with whose stomachs it agrees. It should be used fresh, and an additional quantity of cream may often be used with advantage.

It is important to inquire into and regulate the habits, the occupations, the whole manner of living of the patients—to inquire into their dwelling, and especially their sleeping-rooms, and to select for those who may be able to travel a suitable residence or climate for winter and summer ; and the proper management of the mind should not be neglected.

The prescribing of medicines, however important, is secondary. It must have reference to modifying particular morbid processes, and must always be in connection with hygienic regulations. Care, too, must be taken that the medicines prescribed do not seriously disturb the stomach and interfere with the taking and digestion of proper quantities of food, upon which so much depends.

Whenever the occasion requires, the resources of surgery must not be neglected. Effusions in the chest or peritoneum, or œdema of the glottis, may demand mechanical procedures.

All the means, public and private, which tend to produce healthy localities and healthy homes should by every means be encouraged.

Instruction in individual hygiene should be given, and compliance with its requirements urged.

The marriage of consumptives, or those specially inclined to the disease, should be discouraged, not only on their own account, but in reference to the continuance of the disease in their offspring. Consanguineous marriages should particularly be avoided, more especially if there be the least suspicion of a tendency to phthisis from the family history. If such marriages occur and offspring result, great care in their management should be observed, to prevent the development of the disease. The mother should be particularly watched over during her pregnancy and confinement, and if at all feeble, she should not nurse the child.

The rooms, and especially the sleeping-rooms, of consumptives should be spacious, airy, well ventilated, and well exposed to sunlight. The clothing should be suitable, adapted to the seasons, and agreeable to the sensations ; the feet should be well protected ; there should not be too much muffling about the neck and throat, and respirators are, at least in most cases, quite unnecessary.

The use of cool or cold water externally has marked an advance in the treatment of phthisis. The judicious use of this hygienic and

therapeutic measure is without doubt of benefit, often material, in the management of these cases.

To one unaccustomed to the external use of cold water, it should at first be applied not too cold or too long, by a sponge, and be immediately preceded and followed by friction with a dry towel. These applications should be made daily, and gradually the water may be used colder and more freely applied. The shower-bath may often after a time be used; and the wet pack, when the temperature is high, may be resorted to; but the use of this requires more care and skill. The water treatment may be carried to excess, or used to the exclusion of other important means; but, properly used, it diminishes the disposition to take cold from atmospheric changes, promotes elimination from the skin, renders the reflex actions from the surface more agreeable, and produces a general tonic effect. When the habit of its use is established it becomes enjoyable in its effects, and patients are unwilling to relinquish it.

Exercise in the open air and in the sunlight has been alluded to; but its importance, where it can be borne, is so great that it should be emphasized and its practice should be insisted upon. In a suitable climate, and in the absence of rain-fall, a life literally out of doors is often of great service. Ascending hills and mountains, where the strength is sufficient and the fatigue produced is not too great, is often useful. The lungs are expanded, the breathing capacity is increased, and the general tone of the system is often elevated.

Expansion of the lungs by full systematic inspirations is often useful, and should be daily practiced in cases where the strength will allow. Every form of exercise should be alternated with proper periods of rest. While inaction is injurious, overaction and much fatigue are even more so. Regular hours, retiring early, and a good allowance of sleep, are important.

In more acute, inflammatory, and febrile attacks, so likely to occur in the course of the disease, entire quiet in bed will be required, with appropriate treatment until subdued, when the open-air exercise should be cautiously resumed.

It is fortunate that most consumptives are hopeful, but still there is often much apprehension, and sometimes great despondency.

The courage should be kept up as much as possible; and a brave struggle against the disease is sometimes successful in delaying if not in averting the fatal result. Too unfavorable an opinion, especially if unfeelingly delivered, may produce great shock and depression, and may result in giving the patient over to all the tricks and impositions of quacks, who will promise what cannot be realized, and whose treatment may do much harm.

“Let some heart and compassion be put into these predictions, sad though they may be, and the physician who is at the same time experienced, sympathetic, and gifted with the requisite tact, will receive from a majority of families, even under the most painful circumstances, both justice and appreciation as equitable as it is affectionate.” (Lebert.)

Artificial and medicated atmospheres in the patient's room have been tried, but have disappointed hopes in the past and are no longer relied upon. Various inhalations of medicated sprays with atomizers have been used, and while palliation of some bronchial and laryngeal symptoms has been produced, no special effects upon the course of the pulmonary disease have been realized.

Change of air for consumptives is a matter of great interest. Sometimes the mere fact of change, without reference to the comparative qualities of the atmosphere in the different localities, will have a beneficial effect, especially upon the digestive organs and the nervous system, and thus indirectly upon the lungs. An inhabitant of a town by going into the country, one upon the seaboard by going into the interior, or from the interior to a sheltered situation on the seaboard, will often obtain marked temporary relief, and conjoined with other influences there may be permanent improvement.

In England, patients with consumption are often sent to Ventnor, a sheltered place on the south shore of the Isle of Wight, where in that southern exposure they often improve, not so much from any special influence of the place as by the change from a dingy town, and from their ability to be more out of doors. From all parts of Europe consumptives are often sent to the Riviéra, to Nice, Mentone, Cannes, or San Remo for a winter resort; and the protection from winds by the mountains in the rear, the clear sky and freedom from rain and dampness, the intense light from the direct rays of the sun through a cloudless atmosphere, and the light reflected from the waters of the Mediterranean and the white sand and pebbles of the shore—all have a specially exhilarating effect, and good results, in some cases only temporary but in others more permanent, follow a sojourn at these stations.

In our country a winter sojourn in Florida, in some situations in Georgia, South Carolina, and other southern places is useful; or by a summer sojourn in the North—in Minnesota, the Lake Superior region, and even on the coast of Maine, beneficial effects are realized, not from any inherent properties in the atmosphere which protect from consumption the permanent inhabitants, but from the *change*, a different air and new scenery, and breaking up the monotony of life that had become depressing. This principle should be taken into

account in estimating the influence of particular localities upon consumption.

A prolonged stay in cow stables was at one time advised as a cure for consumption, but little is heard of it at present, and it may therefore be presumed to have disappointed its advocates. It is, however, a change, and Lebert thinks it sometimes useful, and mentions cases of its supposed beneficial effects.

The Grape Cure and the Milk Cure in Europe still have their advocates, and no doubt the changes effected in those resorts often have a beneficial effect upon the general health; but neither a grape nor milk diet has any special influence upon the disease, and should not be relied upon to the exclusion of other means.

The *Climatic Treatment* of consumption, prophylactic, palliative, and curative—that is, treatment based upon the influence of particular climates over the disease—is of much importance, but also of difficulty as to details.

It is impossible within the limits of a work of this kind to give a full account of the different climates and localities which have been recommended for consumptives by eminent authorities; but some general principles may be stated and some of the leading localities referred to.

The chief elements of climate are:

1. *Temperature.* This may be considered in various aspects—positive and relative—uniform and variable, etc.

The absolute or mean temperature of a place is the average heat of the whole year, including winter and summer. This is of consequence to a permanent resident, but is of less moment to one who is a sojourner at a particular season. The relations of the temperature of summer and winter, of different particular seasons, and from month to month, the changes from day to day, and of day and night, the suddenness with which those changes occur, and other conditions accompanying them, have more influence by far than the mean heat. Extremes suddenly occurring are injurious; while moderate changes, relieving a dead, oppressive, monotonous uniformity, especially where the temperature is high, are beneficial.

The expression “range of temperature” is applied to its variations in a given time. Thus, if it is 20° warmer in the daytime than in the night, the range is 20°, and the average daily range, taking one day with another, is called the “mean daily range.”

There is also a “mean monthly range,” a “range of monthly means,” and an “annual range,” as well as an “annual mean.” All these are to be taken into the account in relation to the temperature of a place.

2. *Dryness or moisture.* The hygrometric conditions of the air are more important than temperature in relation to phthisis. The amount of dew is more indicative of the moisture of the atmosphere than the rain-fall.

The influence of moisture and dryness is most marked upon the skin, and through it upon the kidneys and other internal organs; but the lungs, in addition, are affected directly by the moisture or dryness of the air taken into them.

3. *The winds.* Their frequency, direction, and strength—the land or water over which they pass—have marked effects, and those effects are greatly modified by temperature and moisture.

4. *The weight of the air and the barometrical changes.* The ordinary weight depends upon the approach to, or distance above, the level of the sea; but there are fluctuations at the same level constituting an element of climate.

5. *The electrical conditions.* The “electric tension,” not so easily measured, is nevertheless an element of some importance in climate.

6. *Ozone.* The amount of this active condition of oxygen is another element, not precisely estimable, but it is thought to be of much importance.

7. *The purity or impurity of the atmosphere.* The presence in it of organic, decomposing, or inorganic and more fixed elements of gases, dust, etc.; of emanations from the earth, and of living microscopic germinal elements, constitutes conditions of very great importance; but they belong more to particular localities, and yet may have so general a prevalence as to become an element of climate.

8. *The amount of light,* of sunshine or cloudiness, the color of the earth, absorbing or reflecting the light, is an element of much importance, especially in relation to consumption. Under this head, or in connection with light, the “diathermaney” of the air, or the facility with which radiant heat is transmitted, is to be considered. There is much difference in atmospheres in this respect, depending upon their clearness or freedom from vapor or anything which obstructs the heat rays of the sun.

9. *The character of the soil and subsoil*—their composition, porosity, the amount of organic matter they contain, etc.—has an influence. They determine largely the qualities of the drinking water, the moisture or dryness of the place, and the telluric emanations which abound, as well as the amount and character of the vegetation.

10. *Bodies of water, marshes, ponds, lakes, rivers, and the proximity of the sea.* The direction of the winds in relation to bodies of water, the unevenness or smoothness of the surface, the hill-tops, hill-

sides or valleys, all have an influence upon climate or enter into its elements.

11. *The food* attainable in a place, and the influences on the appetite and digestion, the facilities for exercise, society and occupation, the beauty of scenery, and the ease of access are all circumstances to be considered in determining a locality for the residence or sojourn of a consumptive.

12. *Balsamic odors* and ozonic conditions of the air in *pine forests* are other elements of importance in climate or locality.

13. But no condition has as much influence upon phthisis as *elevation above the sea level*. This element of climate has received much attention of late, and is worthy of a careful examination in relation to this disease.

There can be no doubt that phthisis is very rare in high altitudes, and among the inhabitants of some mountain stations it is almost, if not entirely, unknown.

It will be well to make a short analysis of the qualities of climates of high altitudes, in search of an explanation of their effects.

The most marked condition of an elevated situation is the rarity of the air and the diminution of atmospheric pressure.

The proportions of the chief constituents of the air, oxygen and nitrogen, do not vary materially in habitable elevations. It is estimated that at the same temperature the air is a fifth rarefied, and therefore there is a fifth less oxygen in a given space at an elevation of 6,000 feet than at the sea level. This requires that the lungs should inspire a fifth more air to obtain the same amount of oxygen as at the lowest level. This requires deeper or more rapid respiratory movements, and usually there are both. The lungs are thus expanded; for only in exceptional cases, or in disease far advanced, does less oxygenation occur on high elevations than on low levels. A different view has been expressed by some, and the effects of elevation have been attributed to diminished oxidation; but this is strenuously denied by Lebert and by many others who have had abundant opportunity for observation. The increase in the frequency and fullness of respiration causes more or less increase in the frequency of the pulse, and an increase in many of the life movements. The "idle portions" of the lungs, as the less used portions have been called, are brought into requisition, the thoracic organs have their capacities and powers augmented, and the circulation is more free through the lungs.

It is stated by Dr. Dennison, of Colorado, who has written much on the effects of elevation, that the increased frequency of respiration is effected chiefly by a quicker *expiration*, while the inspirations are

less or not at all shortened, though they become more and more profound the longer the stay at the height. This it is naturally supposed would occur.

According to Lebert, in a state of repose a healthy person's respirations are not perceptibly more frequent, and the pulse is not accelerated after one is accustomed to the elevation, but unquestionably the respiration is at least more full and the chest more expanded.

All the oxygen is obtained which can be appropriated, and "once acclimated the patient has more strength, better spirits, more appetite, better digestive power; in a word, a more vigorous exchange of nutrition, which increases the strength of the constitution for its struggle against disease, and which may thus get the better of many difficulties and lesions when there is not too profound impairment, local or general." (Lebert.) He refers in these statements to a sojourn in the Engadine, the highest inhabited part of Europe, from the end of June to October.

The atmospheric pressure is greatly varied by this amount of elevation; and though the exact character of this influence and its amount are not so well understood, there can be but little doubt that they are decided. This diminution of external pressure is not without its dangers, as by it hemorrhages are sometimes induced. This result may be contributed to by the freer flow of blood into the lungs, by the increased respiratory movements and the increased action of the heart. Too high an elevation suddenly reached, when much disease of the lungs is present, is particularly dangerous, as many instances have proved. When a high elevation, as the Upper Engadine, is gradually approached, the patient remaining for some time at a lower preparatory station, according to Jaccoud and Ludwig (the latter a resident of Pontresina), a hemorrhagic tendency is not a contra-indication to a sojourn there.

The effect of altitude upon temperature is well known. In general, the decrease of temperature with elevation is stated to be one degree (1°) F., to every 300 feet. This is, however, varied by local circumstances. In temperate climates it is stated at 1° for 400 feet, and along the eastern base of the Rocky Mountains in Colorado the temperature of most of the places is much higher than the elevation would indicate, or than is found to be the case near the Atlantic coast. This is accounted for by the far inland position, the dry sandy soil, the protection afforded by the mountains from the west and north-west winds, and by the frequent occurrence of warm equatorial and Pacific winds.

From the absence of the equalizing influence of moisture in the air, and the greater absorbing power of the heat by the earth as compared to water, the daily range of temperature—the difference between

day and night—is greater than near the sea-coast. This difference is increased in high altitudes.

A comparatively low temperature is more favorable to the performance of various functions than a higher degree of heat, and this is one reason for the advantages of elevated situations.

A cool atmosphere is more stimulating to the nervous system and increases the influence of atmospheric electricity. Heat in the shade, especially in a humid atmosphere which diminishes evaporation and exudation, increases unduly the temperature of the body, and a cool, dry air is therefore better.

Heat also lessens the frequency of respiration, and when continuous the digestive power, and its opposite increases all these functions.

The low temperature of elevated situations tends to counteract the extreme rarefaction of the air, and the greater activity in the cool and elevated positions causes a freer amount of oxygen to be taken in and appropriated.

These are some of the reasons for the less prevalence of phthisis in colder than in warmer regions, and upon high elevations than upon lower levels.

Not only coolness but *dryness* is favored by high elevations, and we have already seen that dryness is the most important climatic element in the prevention of consumption. It is also one of the most important elements in the treatment of ordinary chronic phthisis, though there are some inflammatory cases which may be soothed and benefited by a temporary residence in a moister situation.

The *diathermancy* of the air, or its facility for transmitting the radiant heat of the sun, is greater in most elevated situations, and the light in such situations is stronger. The influence of direct sunlight and sun heat upon the human body, though not as marked as upon plants and upon some of the lower animals, is still decided, and especially in reference to tuberculosis. The less obstructed and more powerful influence of the sun in high altitudes may account in part for the beneficial effects of these situations. Light stimulates and darkness impedes respiration, and more or less all other functions.

The atmospheric electricity is greater in elevated situations, and ozone is regarded as “electrified oxygen.” These electrical and ozonic influences are more active upon mountain heights, and are believed to be important aids in opposing phthisis. Ozone by its action in oxidizing organic or putrefying materials is an efficient purifier of the atmosphere, and the purity of mountain air is an important element in its healthful properties.

The winds at high altitudes, as elsewhere, have an influence beneficial or injurious, according to their severity, temperature, direc-

tion, constancy, and the conditions of the places from which they proceed.

They tend to purify the atmosphere wherever they occur; they encourage free respiration, but when the temperature is low and winds are violent they cannot be borne by feeble persons. There are many sheltered situations in high elevations, and valleys among high mountains are generally selected for resorts.

These are the climatic elements of high altitudes, and they go to explain their beneficial effects.

But whatever explanation may be given, the fact cannot now be denied that the occurrence of consumption, as a rule, diminishes as the altitude increases, other conditions being similar, so that at an elevation of nine or ten thousand feet at and near the equator, and of from four to six or seven thousand feet in higher latitudes, consumption among the regular inhabitants of such localities is practically unknown. The testimony as to the prophylactic influence of high elevations in this disease is overwhelming and conclusive. Its palliative and curative influence would be inferred, but to what extent and in what cases a residence in such localities will relieve or cure the disease when once commenced and in progress, must be a matter not of inference merely, but of observation and experience.

Concerning the *palliative and curative effects of high mountain resorts for consumptives*, there is much testimony and many opinions from high professional sources, but these opinions vary in positiveness, as is the case upon nearly all therapeutical questions. The fact is, that places of the same high or low elevation, of the same temperature, moisture, and various other conditions, are not alike adapted to all cases of the disease.

As expressed by Lebert in his recent work on consumption, already repeatedly referred to, "*But if it is true that there is no fundamental medicinal cure for tuberculosis, it is equally true that there is no specific climate. I do not mean to say that different stations have not special indications. But I long ago became convinced that neither the smiling shores of Lake Lemán, the Bay of Montreux, nor the beautiful coasts of the Mediterranean with its famous stations at Nice, Cannes, Mentone, San Remo, nor Meran, nor Davos (the most famous of the mountain stations), nor Madeira, nor Cairo, have any direct or specific action upon tuberculous affections, but that their beneficial action lies essentially in their hygienic influence.*"

There can be no doubt that the same may be said of every resort on this continent, and neither Florida, South Carolina, Georgia, Southern California, nor Eastern Tennessee; neither Minnesota, Lake Superior, the North Woods of New York, nor Utah, Colorado, the

Indian Territory, the high plains of Texas or New Mexico, however beneficial many of these places may be in certain cases, can be regarded as specifics, or places to which all consumptives may with propriety be indiscriminately sent. There are various localities capable of fulfilling different indications, and much judgment and discrimination are required in their selection; and when the disease is far advanced, or is pursuing a rapid febrile course, the patient should be sent to none of them, but remain where he may enjoy the comforts and attention of home and friends.

There are various groups of climates, each being more or less adapted to particular conditions of diseases of the respiratory organs, among which may be mentioned the following:

1. Those that are soft and moist, such as Florida, the Azores, and Santa Barbara, California.

2. Those less relaxing, but still mild and rather moist, as Georgia, Madeira, and Lisbon.

3. Those that are dry and hot, of which Malaga is a specimen.

4. Those having warmth, purity, and dryness, as the South-western Plains of our country.

5. Temperate, pure, dry, and elevated, as the elevated plains of New Mexico and Texas, many portions of Colorado, and other situations on the eastern slope of the Rocky Mountains.

6. Cool and dry—cold and equable in winter—as Minnesota, Lake Superior, and the extreme situations of Iceland and Greenland, in which latter inhospitable regions consumption is said to be almost unknown.

There are various stations, especially in Europe, and also in this country, which will not come into either of these groups, where the difference at different seasons is very great, and which are resorted to only at certain portions of the year. Thus Nice and Mentone, and various other stations in the Riviéra, are visited only or chiefly during a few of the winter months, when the mildness of the temperature, the brilliant light, and the freedom from rain render them delightful. Most of the places in the Upper Engadine—Pontresina, St. Moritz, etc.—are visited in the summer months, when the cool, pure, bracing, and greatly rarefied air, and the beauty and grandeur of the scenery are so inspiring.

Davos, very high, very cold, but very dry, has of late been occupied as a winter as well as summer resort. It is protected from winds, and in the middle of the day in winter the sunlight is so bright, the air, and even the snow is so dry, that patients can remain for hours out of doors with proper warm clothing, but must be snugly within doors long before sunset; and some are said to be greatly benefited by such residence.

The very high mountain stations must, as a rule, be approached gradually, and not at all by those far advanced in the disease, or who are suffering from acute inflammatory conditions, or who have much fever.

There must be a certain good degree of digestive power, or a prospect of soon obtaining it, to sustain the excitement, the exposure, the exertion, and the fatigue incident to reaching and remaining in such a locality. When there is much exposure to cold, there must be sufficient food taken and digested to supply the necessary animal heat. The disease should not be far advanced, nor the patient aged. When the general powers of life are exhausted by age, results from such a change of climate are far less favorable.

Comparative youth and vigor are required. In comparatively early periods of chronic cases, there can be no doubt of the beneficial effects of elevated, dry, cool, light, electrical, stimulating climatic situations. For such there are probably no better situations than upon the eastern slope of the Rocky Mountains, in various places in Colorado. For those more impressible and delicate, the somewhat milder, less elevated, and equally dry climate farther south, in some parts of Texas, and especially in New Mexico, would be preferable. Minnesota and the Lake Superior region are less popular than some years ago; and longer experience has shown that consumption not unfrequently originates in these places. Still, some patients receive benefit by removal there.

In bronchial, pneumonic, and other inflammatory cases, a sojourn in the winter in Florida, Santa Barbara, or Georgia, etc., will often be useful; and as foreign resorts Madeira and the Riviéra are to be considered.

In the treatment of ordinary cases of chronic tuberculosis *cool* and *dry* climates give better results than *warm* and *moist*, and both coolness and dryness are increased by distance from the sea and elevation above its level. A particularly equable temperature must not be insisted upon, except in bronchial and inflammatory cases, as equability presupposes moisture, which is far less favorable to the tuberculous condition.

The beneficial effects of high altitudes upon those who are able to bear them should not be lost sight of; and it may be regarded as established, that the stimulating effects of exposure to sunlight and a rarefied air tend to oppose tuberculous formations. Normal tissue changes are hastened by exercise and outdoor life, and are still further aided by a cool, dry, electrical, and elevated atmosphere, which is always best when it can be borne. An elevation of from 3,000 to 7,000 feet is not too much in uncomplicated cases of slow tuberculous deposits in the early stages of the disease.

A somewhat prolonged residence is important in a climate where a consumptive patient finds his disease materially mitigated or arrested. A speedy return to his former residence is often followed by a speedy return of the disease.

As to *particular localities*, a porous soil should be selected; and large apartments, open windows, frequent bathing, and good, substantial, and varied food are essential. In short, all hygienic laws should be strictly observed.

“*Camping out*,” or out-of-door life, even living without a tent in a dry and comparatively equable climate, has in some cases, where a certain amount of vigor continued, been followed by markedly beneficial results. The same may be said of long journeys on horseback; but in all such exposures there is more or less danger of going beyond the strength and endurance of the patient, and speedy failure may occur. Some trial efforts of less severity should precede a full committal to a severe course of exertion and exposure.

Camping out in the North Woods of Northern New York is highly recommended by Dr. Loomis, of New York; and cases are reported of very beneficial effects in some severe forms of phthisis. There can be nothing so different in the temperature, moisture, sunlight, equableness, etc., which can produce very marked effects; but the soil is porous, and the air abounds in balsamic emanations from the pine forests, and is said to be especially ozonic. A winter as well as a summer sojourn is advised, and no doubt may be borne by some with great advantage. Others, it must be presumed, would not endure such exposure, and a tent residence here would in many cases be hazardous, to say the least. Late experience in the North Woods has dissolved the enchantment which a few enthusiastic accounts of exceptional results temporarily produced.

MEDICAL TREATMENT OF PHTHISIS.

However important medicines may be in the treatment of consumption, if not absolutely subordinate to hygienic management, they must be co-operative with it.

The great body of consumptives, however, who commonly come under the care of the physician are unable to avail themselves of a change of climate, or at least cannot resort to far distant places for long periods. The disease is often too far advanced to render such change desirable; and in other cases pecuniary and family considerations present insuperable barriers. Patients must not only be treated at home, but often in homes far from hygienic. In some large cities, as in London, a comparative few are treated in hospitals

devoted to that class of patients; and while opportunities are thus offered for comparisons and the better study of the disease, it is doubtful whether patients would not do better in ordinary homes; and when in crowded general hospitals they often do worse than in poor homes.

The worst class of crowded tenement-houses, damp cellars, with squalid destitution, must, however, in this statement be excluded. In all ordinary cases personal and home hygiene should be the first care, as without it all medicinal measures are apt to be of little avail. One of the most important therapeutical problems of the present time is the management of chronic disease and of those constitutional faults which underlie chronic diseases. The consumptive tendency—the tubercular diathesis—requires special attention, not only in hygienic management but in medicinal treatment, where the physician is consulted in the earlier deviations from the healthy state. Degenerative tendencies may often be averted, and degenerative processes may be checked in their course, if not completely cured, and life greatly prolonged and rendered more comfortable where full health cannot be restored.

The retardation of slow morbid processes, particularly the tuberculous, is an important object of practical and scientific medicine. The frequency of this state, and its great importance, is the justification for so much space occupied in its discussion.

There can be no doubt that great improvement has occurred in the results of treatment of phthisis within the last forty or fifty years, and some of the improvements are within very recent times. A great advancement was made in this country from Rush to Parrish—from the confinement in-doors, and often in bed, with bleeding, mercury to salivation, and antimony and starvation to spanæmia, of Dr. Rush, to outdoor exposure, a good diet, and general supporting measures of Dr. Parrish.

Dr. C. J. B. Williams, in his excellent work on consumption, says: "From 1830 to 1840 little benefit was derived from the treatment I then pursued, and the duration of the disease was seldom prolonged beyond two years, which was the limit given by Laennec and Louis. From 1840 to 1850 a marked improvement took place in results. A more liberal diet was allowed, mild alterative tonics were given, such as iodide of potassium with vegetable bitters and mineral acids." A favorite prescription with him was: \mathcal{R} Iodide of Potassium, grs. ij; Dilute Nitric Acid, gtts. xv; Tinet. of Hops, Comp. Fl. Ext. of Sarsaparilla, āā 3j; Water or infusion of Orange Peel, 3j. M. for a dose.

From 1845 to 1850 codliver oil began to be used. This he adopted, and to it attributes great virtues. In his subsequent experi-

ence among the wealthier classes, who at the same time could avail themselves of climatic changes, he declares the average duration of the disease instead of two years to be fully eight years.

In this change of treatment the fact was recognized that consumption, however connected with the inflammatory processes, is essentially a disease of degeneration and decay, and that the treatment, to a large extent, must be invigorating and sustaining. This is the first and most important view to be taken of the disease. But when coming to details there are so many special conditions, so many symptoms to be palliated, and so many particular pathological states to be controlled, that the treatment is by no means so simple.

Medicinal treatment, as well as the hygienic and climatic, should be directed to prevention, palliation, and cure. The arrest of a bronchitis, pneumonitis, pleurisy, or indigestion, by medicines, in one predisposed to phthisis, is as truly prophylactic of the affection as the hygienic measures which have been described. Palliation of symptoms by medicines is often required; and more specific curative medication, though unfortunately so uncertain as to results, should not be regarded as beyond the possibilities of our art. Some of the means regarded as preventive or palliative may tend to a cure.

The leading indications for the treatment of the disease when actually present, are :

1. To improve faulty nutrition, considering this in its largest sense, including digestion, excretion, elimination, and purification, as well as building up the tissues.

Faulty nutrition is at the foundation of the tuberculous diathesis, the tuberculous formations, and the tuberculous cachexia. Improving nutrition will tend to change the diathesis, to arrest fresh exudations, and to prevent the cachexia.

2. To subdue irritation and inflammation when present, and abate the fever attending the deposit and the changes the deposit undergoes and induces.

So many cases originate in inflammation, and this process is so constant an attendant upon the changes which occur, and plays so important and destructive a part in them, that measures for subduing or abating this process are often demanded.

These measures are various, but they do not necessarily embrace the old "antiphlogistic regimen"—bleeding, antimony, purging, mercury, and a low diet. Some of these means, however, in moderation, for a short time and for temporary effect, may be called for; but there are other remedies for subduing inflammation which are often required.

Checking irritation, inflammation, and fever, diminishes the deposits or morbid growths, and the wasting and exhaustion of the system. The measures for building up the tissues, and for subduing irritation, inflammation, and fever may be quite different, but they tend to the same end—the alleviation of the disease and the prolongation of life. Elimination, though rendered necessary by waste, is a part of the process of repair and renewal. Deficient elimination leads to lowered vitality in the tissues and to a lowered bioplasm. Deficient respiration and deficient exercise lead to deficient renewal and deficient elimination. The causes of these results should, as far as possible, be removed, exercise and free respiration should be encouraged; but in addition various medicines increase elimination and result in purification. Nothing will take the place of the regular, complete, and continuous performance of the respiratory acts; and the hygienic measures already pointed out are indispensable for preventing the accumulation of materials of low vitality constituting tubercle, in those predisposed to this state. But various medicinal substances may aid in modifying the tendency, or even in checking, arresting, and removing the results of the process when it has commenced.

Full systematic expansion of the chest, bringing into requisition the whole breathing capacity, and other hygienic measures, tend to develop the whole vitality; but medicines, by arresting morbid processes, may aid in accomplishing the same beneficial results.

Food is force, and can alone furnish the materials for building up tissues; but medicines may aid the appropriation of that food, and may furnish important materials in which ordinary food is deficient.

The stomach, liver, and bowels may require medicines to correct their abnormalities and excite them to the proper performance of their functions in the process of nutrition. Alteratives, laxatives, tonics, and various promoters of digestion—pepsin, extract of malt, etc.—may be needed.

Excretion from the skin is promoted by exercise, cleanliness, frictions, a dry atmosphere and an elevated situation; but medicines may aid in exciting the function of this organ.

A cool, dry, light, elevated situation, and an electrified atmosphere act as stimulants or tonics; but there are medicinal tonics as well which may aid their effects.

While there may be no consumptive specifics, there are medicines which subdue morbid processes, and which indirectly, if not directly, may co-operate with nature in aiding the typical force to establish health. But there may be medicines which, besides acting on these general principles, have an antagonistic action upon the special morbid processes resulting in the tuberculous formations.

Among the medicines intended to counteract the tuberculous process, I fully agree with Lebert in the opinion that "the preparations of iodine hold the first rank." From his long and varied experience he has come to conclusions so fully in harmony with my own, derived from an experience which has extended over many years, that I may be allowed to quote from a manuscript translation of his work on consumption the following passages :

"I have for a long time used the iodide of potassium, in cases with a syphilitic complication, and have been struck with its good effects and perfect tolerance. For the last twelve years I have made frequent use of this remedy in the treatment of tubercle in its earlier stages, or when moderately advanced. The salt checks the exuberant cellular formation, the hyperplasia, by causing reabsorption, as in goitre and syphilitic gummata, of masses of cells of pathological hyperplastic origin. If this salt is brought into contact with protoplasm, with water and carbonic acid, it is transformed into bicarbonate and into free iodine, which modifies profoundly the albuminoid substances, and the cells which are partly composed of them. There are some cellular masses which appear to have a peculiar affinity for iodine, such as those of hypertrophy of the thyroid gland, of gummata, and of plastic periostitis." He might have added, enlargement of the lymphatic glands. "One great advantage of the iodide of potassium is that it is well borne by the digestive organs, and that its influence upon their functions is favorable. Antiplastic with regard to certain pathological products, this medicine promotes digestion, normal nutrition, and the general health."

He admits that occasionally emaciation and weakness follow the use of the medicine, but he thinks it is only when rapid absorption of morbid matters takes place and the material is suddenly thrown into the blood, and he calls the condition, "*poisoning by rapid reabsorption of morbid substances*," and says, "the term *iodism* appears to me entirely inapplicable." He has not found it injurious even when its effects were not markedly beneficial; but he adds: "From year to year I have noticed more and more the salutary effects of this salt in tuberculosis when not too far advanced." "In the first evolutionary phases of tuberculosis, even when quite a number of foci are formed, it is beneficial. But it must be given a long time and in genuinely therapeutical doses. I order from 5 to 15 or 30 grains a day, in solution, with water and syrup of orange flowers, or in pills with extract of liquorice, $1\frac{1}{2}$ grains in a pill, commencing with one pill three times a day, increasing gradually to twelve or fifteen in the twenty-four hours."

Whether or not these are the exact modes of its action, I am con-

fidant that iodide of potassium very often produces very beneficial effects in early tuberculosis, and in phthisical inflammations.

I have usually prescribed it in combination, and a favorite formula has been something like the following :

R	Iodide of Potassium	3iv
	Syrup of Tolu.....	3iij
	Syrup of Ipecac.....	3j
	Fl. Ext. Veratrum Viride.....	3j
	Sulphate of Morphine.....	grs. ijss
	M.	

Dose, a tea-spoonful three and sometimes four times a day. The proportions of the ingredients are to be changed according to the effects. Sometimes the morphine should be omitted, but if a cough is troublesome, and is more than is necessary for expelling the accumulated material in the bronchi, it gives rest to the lungs and allays irritation and the tendency to the inflammatory processes so likely to occur and to hasten on the disease. The syrup of ipecac. or the veratrum viride may be diminished or omitted if the stomach is disturbed by them, though their modifying influence upon the lungs and bronchi has seemed to increase the beneficial effect of the salt. At the same time the tincture of iodine may be painted upon the surface of the chest, and inhalation of the vapor of iodine is thought to be beneficial.

Iodide of iron, where anæmia is present, is also useful, combining the effects of its two constituent elements; and more iron is absorbed from this than from most other preparations of the metal. Lebert prefers it in the form of Blancard's pills, though the syrup of the iodide is more frequently prescribed, and is an excellent preparation. It may be combined with other articles, and should usually be continued for a considerable period in order to obtain its full effects. When a more ferruginous preparation is required, Lebert advises the following mixture, which has become very popular in Germany and Switzerland :

R	Iodide of Potassium	4 parts.
	Sulphate of Iron.....	2 to 3 parts.

Dissolve in Cinnamon Water, 30 parts; and add Syrup of Orange Flower Water, or Syrup of Orange Peel, 150 parts. Dose, a dessert-spoonful twice a day at first, gradually increased to two or three table-spoonfuls in the twenty-four hours.

Next to the preparations of iodine, and, in the estimation of many of the most eminent and experienced physicians in this disease, first in importance is codliver oil. It is true that doubts have been expressed as to its particular usefulness, and certainly it is not adapted to all stages or cases of consumption; but where the disease is not too far advanced, where it is borne and digested by the stomach and bowels, and where the hectic fever is not severe or constant, where considerable breathing capacity still remains, and where outdoor exercise can be taken, there is no doubt of its frequent great utility.

Codliver oil is composed chiefly of glyceride of oleic acid; it contains some glyceride of palmitic and stearic acids, several volatile fat acids, some bile, and several salts, and among its ingredients a small quantity of iodine and bromine. It is usually more easily emulsified and appropriated than other fats, and, according to Lebert and others, singularly promotes activity in the transformation of matters in the organism and improves nutrition. It not only, when useful, contributes to the production of fat, but it modifies morbid and contributes to the production of healthy nutrition. Under its use the physical signs sometimes improve, the progress of the disease is very often retarded, and the symptoms certainly very frequently improve. A stationary state of the disease is not unfrequently produced, and in some fortunate cases temporary, and very rarely permanent, cures are effected. Such happy action is, however, by no means constant; and the cases where it cannot be borne, or where it apparently does no good, too often destroy all confidence in its utility.

If the skepticism of some authors tends to discourage its use, the testimony in its favor of a large number of careful observers in every part of the world encourages its administration in the cases to which it is adapted, and urges the adoption of measures for rendering it acceptable to the stomach.

Says Dr. Williams (whose excellent work on consumption is the result of a very large amount of careful experience continued for many years), in treating of codliver oil: "This article, when taken into the system in sufficient quantities and for a sufficient time, acts as a nutrient, not only adding fat to the body, but also promoting the healthy growth of the protoplasm and of the tissue cells, and in some way as an alterative counteracts the morbid tendency to the proliferation of the decaying cells of pus, tubercle, and kindred caco-plastic and aplastic matters."

It is easily emulsified and absorbed, is usually tolerated by the stomach, at least as well as other fatty articles, and it causes less bilious derangements than many other fats. It should be given just

after or just before the meals, so as to be digested with the other foods. It is absorbed by the lacteals, rather than by the veins which pass through the liver. Too much of other fatty foods must not be given at the same time; and it must be suspended if "bilious" attacks occur. A blue pill, followed by a gentle saline laxative, repeated if necessary, will sometimes be required to correct such a state, when the oil will again be borne. During its administration the bowels must be open daily, by a proper management of diet and habits, assisted if necessary by a tonic laxative. It is best to commence with a small dose twice a day—about a tea-spoonful, gradually increasing to a table-spoonful two or three times a day, and sometimes more if well borne and digested. It will often be much better taken and borne when given on some acid and bitter preparation; and the combination of such a tonic is often important. Dr. Williams, among other preparations, advises the following, which I have often prescribed with much advantage:

℞	Acidi Phosphorici dil.....	℥ss
	Tinct. Cascarillæ.....	℥jss
	Syrupi Zingiberis.....	℥j
	Infusi Aurantii Comp. ad.....	℥viij
	M.	

Sig. Put a table-spoonful in a wine-glass, with a little water if preferred, put the oil upon it, and take at a draught just after meals.

Lately I have used the following prescription as an adjunct to, and vehicle for, the oil:

℞	Acidi Phosphorici dil	℥ss
	Tinct. Cascarillæ	℥jss
	Syrupi Zingiberis.....	℥j
	Quiniæ Sulph.....	℥j to ℥ss
	M.	

Sig. Put a tea-spoonful in half a wine-glass of infusion of wild-cherry bark, and add the oil as to the former prescription. Tinct. nux vomica or some other tonic bitter might be used in place of the quinine, or in connection with it, as thought best in particular cases. I have sometimes used salicine instead of the quinine. Dilute nitric or sulphuric acid may be used instead of the phosphoric. Some preparation of this kind greatly aids the tolerance and the effects of the oil.

Some advise that, in whatever form it is given, from twenty minims

to a drachm of ether should be added, as it is alleged that this article increases the flow of the pancreatic fluid and thus favors the emulsification and absorption of the oil ; and there appears some foundation for this recommendation.

A distinction should be made between repugnance to taking the oil, and an intolerance of it after it is taken. The former may be overcome by proper vehicles or by taking it in capsules, but the latter will justify, and will often demand, its discontinuance. If the stomach does not tolerate it, and cannot be made to do so by correcting its dyspeptic conditions, the oil must not be insisted upon, whatever the general indications for its use. When an obstinate diarrhœa exists, or ulcerations of the intestines are present, its administration will be useless, as it will not be appropriated.

When there is much hectic, and often in the acute forms of the disease, it will not usually be well borne. The diet, when the oil is to be taken for a long time, must be regulated and adapted to the conditions of the system, taking into the account the dietetic properties of the oil.

Some recommend that it should be taken clear, and some sapid substance taken immediately after ; and some patients may prefer this to the methods described. Individual preferences should be respected ; but with most persons some vehicle will render it more easily taken.

A variety of compounds of other articles with the oil have been devised and offered to the profession and public. It may be found combined with the extract of malt, with various preparations of iron, iodine, phosphites, and hypophosphites, and some of these are well adapted to particular cases.

The propriety of such combinations will be better understood after the effects of the various substances used for the mixtures have been considered.

There is one objection to the various proprietary emulsive combinations of codliver oil, and that is, that an inferior article may be used and its objectionable character concealed by the mixture. When there is confidence that a good article is used in the preparations, they often have advantages which will render their use advisable.

The preparations of lime, the phosphate, the lactophosphate, phosphite and hypophosphite, and the phosphite of soda, have obtained a noticeable reputation in the past, and still hold it to a certain extent in the minds of some. There are, doubtless, occasions and cases when by their use a needed ingredient is added to the system and nutrition is improved. A little lime-water with milk will sometimes modify favorably the action of this important article of food.

My own experience with the phosphites and hypophosphites in

phthisis has not been sufficient, or of a character, to enable me to express a personal opinion of their value; but they require attention in taking a survey of the therapeutics of chronic phthisis.

Dr. Churchill, of Paris, has been most enthusiastic in recommending these remedies. A table-spoonful of the solution of the hypophosphite of lime or soda, of the strength of six or eight grains to the fluid ounce, is given once or twice a day, and is more useful in the early stages than later in the disease. Indeed, when tubercular softening has commenced, some practitioners are of the opinion that these articles hasten the destructive process.

The syrup of the lactophosphate, perhaps the most popular of these remedies at the present time, is given in doses of from a teaspoonful to a dessert-spoonful three times a day.

The chlorate of potash, some years ago, was brought forward as an important remedy in chronic tuberculous disease. Although it is a remedy very often used in various minor affections, less is heard of it of late in connection with consumption. I have made not unfrequent use of it, and believe it in some cases to have decided effects in improving ultimate nutrition, and fear it has fallen into an undeserved neglect in the treatment of this disease. If given too freely it irritates the alimentary mucous membrane, and if long continued may do mischief to the kidneys, upon which the burden of its elimination is chiefly thrown. But I have too often seen improvement take place under its moderate use to regard it as without beneficial effects in the treatment of phthisis. It may be given in quantities of from a half drachm to two scruples or a drachm in the twenty-four hours, in divided doses well diluted, so far as I have observed, without material injury, and often with the effect of not only improving the general nutrition, but, as it has seemed to me, of sometimes modifying favorably the condition of the lungs. Although the hopes which for a time were entertained of its effects have been disappointed, I think it worthy of farther attention and trial.

Arsenic is another remedy which has long had a place in the armamentum used against consumption. Though highly praised by some, its beneficial effects can scarcely be considered as fully established. Lebert says his long-continued study of the subject has brought him to the conclusion that it possesses but few properties that are useful in counteracting tuberculous diseases. But he thinks its use rational, as sometimes it acts favorably upon nutrition and tends to check certain dystrophic conditions. When administered, it must be in small doses long continued, as two drops of Fowler's solution three times a day.

Bartholow regards it as worthy of special attention in incipient

phthisis for its effects in "promoting the appetite and favoring tissue-forming, while it corrects the disordered state of the stomach mucous membrane." When it produces these effects it will do good by promoting the general health, whatever particular effect it may or may not have upon the tuberculous or fibroid state of the lungs.

The ext. of malt, without having any specific effect upon the tuberculous condition, often markedly improves digestion and nutrition, and aids in building up the system, and it deserves at least a degree of the popularity it enjoys. It is often used in combination with codliver oil or the hypophosphites, or in a pure state.

The preparations of pepsin and pancreatin, where the digestive power is feeble, may be of essential service. The condition of the stomach requires attention always.

Pure *wood creosote*, in doses of from two to four drops, has been lately recommended as possessing particular efficiency in consumption, but it has not been sufficiently tried to justify definite expressions of opinion respecting it. While it may be found a very useful remedy, it is quite as likely to share the fate of many other articles that have been brought forward with hope and laid aside with disappointment.

Various balsamic and terebinthinate articles have been recommended, and however useful they may be in some bronchial complications, they cannot be regarded as having any particular effect upon the tuberculous conditions.

The remedies we have been considering for the most part have for their object the correcting of the consumptive diathesis or cachexia, the prevention of the tuberculous formation, or its removal in the early or crude state—in short the retarding or arresting of the course of the disease.

When tubercles or other low-lived bioplasms have freely formed, and are going on in their destructive course, with the inflammatory processes which accompany them, other problems arise and other indications present themselves. As the disease is progressive—deposits taking place in some parts while destructive changes are occurring in others—the means we have been discussing are to a greater or less extent applicable throughout its course, and, moreover, all means which invigorate the system tend to establish healing processes where destructive lesions have occurred. When tubercles are advanced, and caseation of them or of inflammatory products has taken place, the method of cure, if a cure occurs, is by softening, followed by absorption or extrusion of the morbid material.

Are there any means for promoting these processes without producing farther destructive changes, or doing harm in any respect? This appears to me a matter of great uncertainty; but Dr. Bartholow

thinks that a combination of *carbonate* and *iodide of ammonium*—from five to ten grains of each, in solution in water, three or four times a day—has that effect, and he advises that this remedy should be resorted to “when the vesicular murmur is assuming a blowing character and the sonoriety is diminishing, and it should be continued for several weeks or months, if improvement is manifested under its use.” (Prac. Med., p. 371.)

But there are other indications less obscure, and other means for their fulfillment less uncertain.

More or less acute attacks of inflammation and its accompanying fever are frequently occurring, and have much to do in hastening on the morbid deposits and the destructive processes.

The most effectual remedy for checking these inflammatory attacks, after some gentle elimination, should that be necessary, is a combination of *quinine* and *morphine* in free doses. Either of these articles alone will generally have a prompt and decided effect, but the combination is more efficient. From five to ten grains of quinine, with a sixth, a quarter, or a third of a grain of morphine, repeated a few times until twenty-five or thirty grains of quinine are given, with sufficient of the opiate to produce its full anodyne and relaxing effect, is almost certain to check such inflammation, whether it is chiefly of the bronchial tubes, the lung substance, or the pleura. This effect may be aided by fomentations and counter-irritation, but these means may not be required. Aconite, veratrum viride, gelseminum, and even antimony are sometimes given, and may be useful, but they are less effectual than the quinine and morphine, and the latter combination is more innocent in its ultimate effects. Such heroic measures could not safely be long continued, nor are they necessary—the inflammation, certainly as a rule, will be speedily checked. The usual supporting measures may then be resumed. A more persistent fever of a hectic character, depending upon the progress of the tubercular disease or upon the caseation which occurs, is not so easily subdued. We know of no means particularly effectual for subduing this fever. Quinine may abate it for a short time, but it will return while the process giving rise to it continues. Still, the fever may often be kept some degrees lower by the administration of antipyretic doses every second morning. The physician must decide in each case whether it is better to give such large and repeated doses or allow the fever to take its course. Smaller doses more frequently repeated will diminish the fever. I have often seen such doses kept up for some weeks with apparently decided benefit.

Lebert advises from two to four parts of salicylate of soda to one hundred and twenty of water, and thirty of syrup of orange peel,

to be given in table-spoonful doses every two hours, or less frequently as may be required.

Combinations of salicylate of soda and quinine are also advised. Digitalis may have the effect to abate the fever, and is advised for that purpose. It is preferred by many in infusion or substance, and in sufficient doses to diminish moderately the frequency of the pulse. Cool sponging may at the same time be used.

The night sweats of hectic are exceedingly uncomfortable, and various means have been used to suppress them. There are many that have a reputation and that often are useful, but they are all liable to fail in their turn.

Among the older remedies for this purpose are the elixir vitriol, the nitrohydrochloric acid dilute, each in half-drachm doses at night; a plentiful drink of strong sage tea; gallic acid in ten-grain doses; quinine in elixir vitriol; tincture of iron; oxide of zinc in two to four grain doses at night (said by Dr. Williams to be specific, prompt, and lasting); and more recently atropia has been much praised, given hypodermically at night in doses of $\frac{1}{100}$ to $\frac{1}{75}$ of a grain, or by the mouth $\frac{1}{60}$ of a grain at bed-time, or, as is thought best by some, for its other effects upon the lungs, from the $\frac{1}{200}$ to the $\frac{1}{100}$ of a grain three times a day. A combination of codeia, atropia, and strychnia (codeia, 1 grain; atropia, $\frac{1}{100}$; strychnia, $\frac{1}{30}$) is said to be highly efficient as a remedy for cough, for night sweats, and for reflex vomiting. Picrotoxin, in doses of $\frac{1}{100}$ to $\frac{1}{50}$ of a grain, is said to check sweats and vomiting. Where atropia fails to arrest the sweats, pilocarpin in doses of $\frac{1}{50}$ to $\frac{1}{10}$ of a grain is advised to be tried. It is said sometimes to have remarkably good effects. In the trials I have made with pilocarpin it has frequently failed. Homatropin has lately been advised for the night sweats. The usual dose is $2\frac{1}{2}$ grs. in a pill, or $\frac{1}{4}$ to $\frac{1}{2}$ or even 1 grain by hypodermic injection. It is said that a single dose will usually stop the sweats for several days, and that the fever and the cough are also lessened, and the course of the disease checked. It has less toxic effect than atropine.

The *cough in phthisis* is often very troublesome, and sometimes it aggravates quite materially the disease. In some cases it is troublesome only for a time, and in others it persists throughout the disease. With some it occurs chiefly in the night, while with others it is much the same day and night. In some cases it occurs chiefly on lying down and on rising, or other changes of position. There is no remedy equal to opium or its preparations for allaying this symptom, and, as a rule, it may be used, often in combination with other remedies; and if judiciously managed and combined, it may generally be given with propriety. In some cases it does not agree with the nerv-

ous system, it tends to constipate the bowels, it sometimes affects unfavorably the appetite and the digestion, and in protracted cases the habit of opium-taking in large and increasing quantities may be established, and this habit may be injurious and difficult to regulate or restrain. In many cases great caution in its use is required, and not unfrequently other articles must take its place. The other vegetable narcotics, as belladonna, hyoscyamus, haschisch, or-stramonium may be tried. Sometimes gargling the throat with a solution of bromide of potassium, or with a mixture of chloral and camphor, will be useful. Hydrobromic acid with spirits of chloroform in proper doses; chlorodyne; occasionally inhaling a few whiffs of chloroform from a vial; various demulcents; the use of troches of liquorice, opium, ipecac., or conium, etc., may sufficiently control the cough.

Codeia is regarded as the least objectionable of the preparations from opium, and may be given in combination with various other articles.

Where the cough is frequent, and more than is necessary for the expulsion of the mucus, the patient should be instructed to restrain it as much as possible. Yielding to every slight impulse may establish a habit of unnecessary coughing, which might have been avoided.

A reflex vomiting sometimes occurs in connection with a severe and paroxysmal cough; and this is perhaps most effectually allayed by proper doses of strychnia.

A creosote mixture may also be used for this purpose, and possibly other very beneficial effects may follow its use. Chloral hydrate, bromide of potassium, hydrocyanic acid, and various other articles and mixtures aid in allaying irritation which results in cough and its consequences. A favorite prescription with Lebert is as follows: Chloral hydrate from 2 to 3 parts, 150 parts of water, and 50 of simple syrup;—dose, a table-spoonful three or four times a day—or a larger dose in the evening. This will often quiet the cough without much narcotism and without producing constipation.*

* Various prescriptions are used by different physicians and in hospitals as palliatives of the cough, promoting expectoration, or allaying irritation. Combinations must be made adapted to individual cases, but in the margin are specimens which may aid the young practitioner in his management of his patients.

R̄ Cyanide of Potash,
Sulph. of Morphine..... ʒss gr. j
Syr. of Tolu..... ʒij

M.—Dose ʒj, more or less.

R̄ Hydrocyanic Acid, dilute..... gtts. x
Bromide of Potassa..... ʒij
Syrup of Wild Cherry..... ʒvj

M.—Dose from ʒiij to ʒv.

When the expectoration is difficult, the matter viscid and adherent, Lebert says, iodide of potassium in solution, to the extent of from 15 to 30 grains in the twenty-four hours, is the best expectorant. This article, when given in a mixture such as was mentioned on a preceding page, the proportions of ingredients being varied according to the conditions, will often cause the expectoration to be more free for a time, and then to diminish in amount with the diminution of the cough. The turpentine emulsion, with a drop or two of creosote in each dose, sometimes produces an excellent effect upon the cough and other symptoms, when largely dependent, as they very often are, upon a catarrhal state of the bronchi.*

The acknowledged influence of iodide of potassium in relieving chronic bronchitis is an additional reason for the use of this drug.

Various soothing and alterative *inhalations*, as advised in bronchitis, will often be useful, as a bronchitis is so often an important part of the pulmonary disease. †

* The following formulæ are applicable to particular cases :

℞ Comp. Spts. of Ether,
Liq. Sulph. Morph. (U. S. P.)..... āā ʒ j
M.—Dose ʒ j.

℞ Dilute Hydrocyanic Acid..... gtts. jv
Bicarb. of Soda... grs. xv
Water..... ʒ j
M.—For a dose.

℞ Chloric Ether..... gtts. x
Tinct. of Squills..... gtts. xx
Tinct. of Opium..... gtts. iij-x
Honey..... grs. x
Water..... ʒ j
M.—For a dose.

℞ Comp. Tinct. of Benzoin..... gtts. xx
Oxymel of Squills..... gtts. xxx
Wine of Ipecac..... gtts. v
Tinct. of Tolu..... gtts. v
Water..... ʒ j
M.—For a dose.

℞ Fl. Ext. Eucalyptus Glob.,
“ “ Yerba Santa..... āā ʒ j
Iodide of Potassium..... ʒ j
M.—Dose ʒ j, more or less.

† Various formulæ for inhalations will be found convenient and useful.

℞ Chloric Ether,
Tinct. Hyoscyamus..... āā gtts. xxx
Hot Infusion of Hops..... ʒ viij
M.—Use with common inhaler.

When expectoration is excessive the same general means as were recommended in bronchorrhœa will be required. When profuse purulent expectoration from cavities occurs, quinine, and perhaps the mineral acids will be required.

Antiseptic inhalations in advanced stages are now strongly advised; and when we consider the bacterial theories at present so prevalent, and the possibility, not to say certainty, of self-infection from ulcerating cavities, these inhalations seem to be indicated. Carbolic acid has been recommended and much used for the purpose; but recent investigations have thrown much doubt upon the great efficiency of this substance as an antiseptic in the sense of a destroyer of bacteria, and especially of their spores. It, however, has considerable powers in hindering the development of spores and in killing developed bacilli, in such concentration as may be borne by the living tissues of the body. The most efficient destroyers of micro-organisms are solutions of bromine, iodine, and chlorine; and solutions of corrosive sublimate are most efficacious in destroying spores, and are peculiarly so in checking the activity of the organisms. Certain volatile oils, particularly *thymol* and *terebinthine*, are efficient in checking putrefactive changes. These various substances may be inhaled of such strength and for as long periods as can be borne, probably with much benefit in checking destructive processes, and are worthy of careful trial. Commencing with one or two per cent. solutions of iodine, bromine, or chlorine, with an atomizer or simple inhaler, the strength may be varied as may be necessary, and thymol and terebinthine may be used with still more freedom and concentration. Terebenc has an agreeable odor of pine woods, rendering it more acceptable for purposes of inhalation; and its use by the stomach, in

R Comp. Tinc. Benzoin..... 3 j
 Water at 140° F..... 0j
 M.—Inhale.

R Spts. Camphor gtts. x
 Alcohol..... gtts. xx
 Water..... 3 j
 M.—Add to a pint of hot water. Inhale slowly.

R Chloroform,
 Alcohol..... aa 3 ss
 M.—Add a tea-spoonful to a pint of blood-warm water. Inhale.

R Carbonate of Soda..... ʒj
 Fl. Ext. of Conium..... 3 ij
 Water at 140° F..... 3 xx
 M.—For a sedative inhalation.

doses of from six to twelve drops, in an emulsion or with magnesia, produces an expectorant effect and lessens intestinal infection from swallowing the sputa.

Answering a similar indication, injections of antiseptic substances into vomicæ through the chest walls, by the means of a long hypodermic syringe, have been recommended and practiced with alleged beneficial results. Solutions similar to those inhaled may be used.

The treatment of pulmonary hemorrhage has been so fully dwelt upon in another connection that further discussion here is rendered unnecessary. Its more frequent occurrence in tubercular disease than in any other conditions rendered it proper to specially direct the account of its treatment to its existence as a complication of consumption.

The treatment of the Diarrhœa, so frequently an attendant upon the latter stages of the disease, is a matter of importance, but of no little difficulty. As it is usually dependent upon tuberculous ulcerations of the intestines, which in many cases will not heal, only palliative treatment is available. I know of no one combination more likely to benefit this diarrhœa than the turpentine emulsion, which has been frequently referred to.

Bismuth, bismuth and opium, and various astringents will have an effect in restraining temporarily, and in some cases permanently, the discharges. Great care of diet when diarrhœa is present will be required. Small doses of arsenite of potash with opium are thought to have a beneficial effect in some of these cases.* Ten drops of the fluid extract of Coto bark in a tea-spoonful of paregoric will often answer the indication.

Pains in the chest are sometimes troublesome, when chloroform liniment, mustard plasters, flying blisters, iodine tincture, and dry cups may be used; and when the pains are more protracted, belladonna plasters, or hypodermic injections of morphine or atropine, or a combination of both, may relieve them. *Dyspnœa* is sometimes so troublesome as to require attention. It is often paroxysmal, and dependent more upon nervous irritation than upon the diminished capacity of the lungs.

In such cases anodynes and antispasmodics have a decidedly beneficial effect. Ether, mixtures of chloroform inhaled or taken by the

* R	Fowler's Solution.....	℥ ij
	Tinct. Opium.....	℥ x
M.—Sig.	Twelve drops two or three times a day.	
Or ;		
R	Aromatic Sulph. Acid.....	℥ jss
	Tinct. Opium.....	℥ j
M.—Sig.	Twenty-five drops as may be required.	

stomach, hydrate of chloral in cautious doses, and sometimes valerianate of ammonia, will be useful. When the pains are very severe, preparations of opium in moderate quantities may be added to other mixtures.

The Quebracho bark seems to be obtaining a reputation for relieving a sense of dyspnœa and promoting the oxidation of the blood in bronchitis, asthma, emphysema, etc., and when, in phthisis, dyspnœa depends upon bronchitis, so often accompanying it, or upon neuropathic conditions, this remedy seems worthy of a cautious trial. A fluid extract is manufactured, of which from twenty drops to a fluid drachm is a dose. In large doses it sometimes produces unpleasant effects, and therefore its use should be commenced in small doses and gradually increased, observing the results.

Tuberculous, Inflammatory, and Ulcerative Disease of the larynx, so often accompanying phthisis, requires attention.

When there is much pain in the region, difficulty of swallowing, and a frequent and tiresome cough, a few leeches near the part have been recommended; but they are of doubtful propriety and should be withheld when there is much debility.

The symptoms are better quieted by opiates internally, by emollient applications or hot compresses, and by narcotic vapors of hyoscyamus or belladonna, etc.

Inhalations, by means of the atomizer, of various substances, as alum, tannin, or nitrate of silver, and applications of a solution of nitrate of silver of the strength of from five to ten per cent., once in a few days, are sometimes useful. Counter-irritations with liniments or flying blisters are often used and may procure some relief. If much difficulty of swallowing solid substances is experienced, the diet should be mostly of milk, soups, custards, etc.

The inhalations of soothing vapors are sometimes required for present relief. The following will often be found useful where the irritation is marked and the cough troublesome :

R Dilute Hydrocyanic Acid ʒj
Water to..... ʒj

M.

A drachm of this to a pint of tepid water (80° F.) for inhalation.

Or,

R Ether (Sulph. or Acetic),
Alcohol āā ʒj

M.

A tea-spoonful to a pint of water at a temperature of from 80° F. to 140° F.

When the disease is not too far advanced, a sojourn in a milder climate for this and other inflammatory conditions may be advised.

In the earlier stages the iodide of potassium, and later the iodide of iron, etc., as where the disease is more confined to the lungs, will be required.

Aphthæ, so likely to occur toward the last, may be treated as in other cases, often by gently removing the exudate, and applying washes of the chlorate of potash, solutions of carbolic acid, and various antiseptics and astringents; and sometimes the aphthous spots may be advantageously touched with nitrate of silver, very gently, in substance, or in solution by a brush.

Fistula in Ano sometimes complicates a case. There are differences in opinion as to the propriety of surgical interference in such cases. If this complication is not painful or particularly troublesome, it may not be interfered with, as on the principle of counter-irritation it often relieves the pulmonary symptoms. Should, however, the discharge from the fistula be profuse and exhausting, or specially painful and troublesome, and the disease not too far advanced, the usual operation may be resorted to.

Catarrh of the Stomach, Tubercular Peritonitis, or whatever other complications may exist, will require attention, and such treatment as their conditions and symptoms may severally demand.

The *Treatment of Acute Tuberculosis* affords little prospect of success. Free doses of quinine to control the fever, the free use of iodide of potassium, and, if the disease is more subacute, codliver oil and general supporting measures, together with anodynes as the sufferings may require, afford the best prospects of relief. A course of treatment such as was advised in tubercular peritonitis may be tried; a fatal termination, however, is to be expected.

The *Treatment of Fibroid Phthisis* will not differ very materially from that of the general form of chronic consumption, which has been the chief subject of the preceding discussion. More or less of the fibroid element exists in nearly all the cases, and its proportion in each is not easily determined.

In the cases markedly of the fibroid character, the iodide of potassium is no less, but rather more strongly, indicated than in those that are more tuberculous primarily, and there is more prospect of success in the treatment of the fibroid cases.

I am confident of having not unfrequently witnessed the arrest of this form of the disease, when promptly and perseveringly treated in the earlier stages by free doses of iodide of potassium, variously combined with other measures.

The prescription in the margin,* with a gradual increase in the proportions of the iodide, with a diminution or omission of the opiate (though not if the cough is harassing, as it often is), persevered with, has been the chief reliance. As cheesy degenerations and tuberculous developments are likely to follow, depressing agents must be avoided, and tonics, codliver oil, ext. of malt, etc., with climatic changes may be required.

The use of Alcohol in the *treatment* of consumption requires an additional notice. It has been sufficiently shown that, as a prophylactic measure, the free use of alcohol has no merits. This does not, however, prove its inutility as a therapeutic agent when the disease is established.

There is no proof of the special or specific power of any article of the materia medica to prevent consumption, though there are various medicines that are useful in its treatment. The question of the utility or the inutility of alcohol in phthisis, as of every other remedy in whatever disease, is to be determined by a knowledge of its general physiological and therapeutical effects, and of the pathological condition for which it is prescribed; and the conclusions drawn are to be confirmed or contradicted by actual observation and experience in a sufficient number of cases; and it hardly needs to be said that this last is the final and most conclusive test, when extensively and fairly made.

It will be borne in mind that phthisis is a disease of lowered vitality, of impurity of the system; one in which pathological deposits accumulate, especially in the lungs, which finally go on to degeneration and decay. What is the ordinary effect of alcohol on these processes and conditions? Does it increase vitality, energy, and purity, or does it have the opposite effect? Does it diminish or does it increase the tendency to morbid deposits, to degeneration, and decay? Is the drunkard or the tippler more capable of resisting the occurrence of morbid processes, or more capable of enduring them when they occur? Certainly, on general principles, we should not conclude that habitual drunkenness or tippling would prevent this disease.

The *a priori* presumption is against it, and it will require very positive evidence to remove that presumption.

* R	Iodide of Potassium.....	3v
	Syrup of Tolu,	
	Glycerine.....	ss ʒij
	Syrup of Ipecac.....	ʒj
	F. Ext. of Veratrum Vir.....	ʒj
	Sulph. Morphine.....	grs. iij

M.—Dose ʒj three or four times a day.

What is the testimony of experience? There can be no doubt that, taking the world over, the great body of authoritative testimony is immensely against the assumption that the free use of alcohol—that anything approaching semi-intoxication—relieves the more essential symptoms or retards the progress of the disease. In countries where the almost universal custom is to take more or less wine or beer daily, though the continuance of the practice may be allowed, very few physicians insist upon its continuance in consumption; and I know of none who advocate the large use of spirits or of wine. There are no higher practical authorities from thorough study of the subject, and long, varied, and extensive experience, than Williams and Lebert; and the testimony of both of these is explicitly against the practice of alcoholization in phthisis.

I have not prescribed whisky in free and long-continued quantities in consumption, and may therefore be supposed to be incapable of expressing an opinion from experience. I have, however, seen many patients who have been prescribed for in this way; have observed the effect of the supposed remedy, and of its discontinuance; have seen those who thought themselves benefited by it, who under its narcotic influence have had their sensations rendered more agreeable, their cough perhaps lessened, their emaciation checked, and the quantity of food and exercise taken increased; but I have not seen the pulmonary disease thus arrested, nor, so far as I could judge, materially retarded. I have more frequently witnessed a failure to produce even these apparently beneficial effects; and the discontinuance of the whisky has very generally been followed by improvement of the condition of the patient.

I have seen some cases reported to have been cured by the free use of whisky, and though there was a history of a cough and other pulmonary symptoms, the existence of phthisis was in most cases extremely doubtful; and in those less doubtful, other means, such as codliver oil, an improved diet, outdoor exercise, change of climate, were simultaneously used, rendering the agency of the whisky in the cures entirely uncertain. I am quite sure that, in my own direct observation, I have seen more harm than good produced by the free whisky treatment; and my observations for the last forty years have extended to many cases.

That alcohol has no specific anti-consumptive influence must be regarded as most probable, if not entirely certain; and its use in phthisis falls under the same conditions and rules as in other chronic diseases.

The holding and teaching of the doctrine of the prophylactic and curative effects of free quantities of alcohol in phthisis, though

almost confined to this country, I am compelled to consider particularly unfortunate, both as regards the interests of consumptives and those of the general community. It has occasioned the entertainment of false opinions, and the establishment of injurious practices in the use of this agent.

That it may be temporarily useful under particular circumstances in phthisis is not denied; but its usefulness is restricted to the relief of particular symptoms, and is dependent upon its peculiar narcotic action. Its appropriation as a food is at least inconsiderable, if not practically nil; and its direct stimulating effect, in the sense of essentially and permanently increasing vital activity, is a myth. Its effects upon the stomach and liver and the process of digestion have elsewhere been discussed, and some of the circumstances in which it may do harm or good have been pointed out. The views there expressed are applicable to this, as to other diseases, and need not be repeated.

Some of the particular symptoms which a moderate and occasional use of alcohol may relieve are, faintness and a sense of depression, nausea and a loss of appetite, sometimes sleeplessness, and some forms of indigestion. Given with codliver oil, it will sometimes aid the stomach in tolerating this article. Lebert advises in some cases for this purpose a tea-spoonful or two of rum. The oil may sometimes be taken upon a little wine or beer with advantage, though the mixtures recommended by Williams generally answer a better purpose.

An outline of the course which my study of this subject and my experience in practice have led me to advise in typical, uncomplicated cases of tubercular phthisis, may be briefly summarized as follows:

First in importance is proper regulation of all the hygienic conditions, including climate and locality.

Directions should be given for a change of climate where that is advisable and practicable.

Attention to the condition of the digestive apparatus is of primary importance, and its abnormalities must be corrected by such means as may be indicated.

Iodide of potassium is to be given either alone or in various combinations, and this is to be persevered with for weeks, and perhaps months, if well borne, as it generally though not always is. The iodide of iron may be substituted, especially if there is anæmia, or if the iodide of potassium appears to have in any degree a debilitating effect.

At the same time, in cases more advanced, and where emaciation without much fever is present, the codliver oil may be given when

the stomach will tolerate its use. In cases where the treatment has commenced early, the oil may be given after a few weeks, and where it is well borne it should be continued a long time. It should generally be commenced in small doses and gradually increased; and in many cases it is important to give it upon one of the acid, aromatic, and bitter mixtures, or with the extract of malt.

The phosphates, the hypophosphites, chlorate of potash, possibly arsenic, quinine, and other alterative, tonic, and supporting measures may be resorted to, as particular general conditions may seem to indicate.

A change of climate is to be prescribed with great care and discrimination, and it is often better that the patient remain at home.

A patient should not be advised to travel any considerable distance unless the disease is in its earlier stages, is without very severe symptoms, or, if later, unless it is in a comparatively quiescent stage. If the temperature be high, comparative quiet is indicated.

No severe secondary complications should be present, intestinal, gastric, or any other, if travel is to be advised.

A patient with a single chronic cavity with retracted walls, if not hemorrhagic, may be removed to a dry, elevated, bracing locality; but if the disease has gone to the extent of excavations, and is progressing with considerable fever, there is danger of the progress being made more rapid by the travel and by a stimulating climate.

When the tendency to hemorrhage is marked, a sudden change to an elevated situation is particularly dangerous.

Diffused deposits, if not very extensive, and especially if confined to one lung, where there is an absence of much dullness or other evidence of massing of the disease, and where the chest is well developed, will allow of a sea voyage.

The first stage of chronic cases is best for traveling, and if there be a complication of asthma or bronchitis, the prospect of benefit is greater.

If there is a large amount of local disease in any stage, in active progress, with much fever, and especially if both lungs are involved, and there is poor digestion and greatly lowered nutrition, emaciation, etc., the patient needs home comforts and comparative quiet.

In all cases, wherever the patient is situated, special symptoms are to be met and palliated; acute attacks of inflammation are to be arrested as speedily as possible; the cough, if severe is to be abated; the night sweats and diarrhoea are to be checked; local antiseptic measures may be resorted to, and the patient is to be encouraged to a vigorous effort to resist the disease.

DISEASES OF THE HEART.

As one of the immediate vital supports of the organism, the heart, with its curious structure and mechanism, its frequent abnormalities, and its intimate relations to other organs, requires attention quite as imperatively as any of the other parts of the system which have been considered.

Its anatomy and physiology are supposed to be understood by the reader; but unless the leading facts are fresh in mind, much that will be said of its diseases will be unintelligible. The circulation of the blood, so immediately essential to life, is kept up by the constant action of this organ, and its actions are adapted to the varied conditions of the system, both in health and disease, by a mechanism and nervous supply which is a marvel of complexity and physiological harmony.

The primitive condition of the heart in the foetus is that of a tube of involuntary muscular fibres, becoming, as it develops, first a pulsatile sac, and at length the four-chambered organ with its valvular arrangements, by which the blood is supplied to the lungs for aeration, and to the general system for nutrition. The heart, in some of the lower animals, retains the primitive condition as found in the human foetus, and a study of the stages of development in the different classes of animals might afford hints respecting its functions and their derangements in man. But the present limits will not allow of such digression, however interesting it might be, and the heart will be treated of only as found in the human subject.

The tube, consisting of a thin layer of muscular fibres in the early stage of foetal life, is gradually changed into a sac of several layers of muscular bundles until it becomes like a coiled spring, the fibres intimately interlaced, but still observing an order of arrangement, so that in the fully developed heart the innermost layer passes spirally from base to apex, while the centre layer is almost circular, and the outermost passes spirally again, but from the apex to the base. By this arrangement the muscular contraction presses the blood out of the cavities, and they are quite emptied at each cardiac systole.

Within the sarcolemma of each muscular bundle are elements of undeveloped fibres, which, however, in hypertrophy and in renewal after the wasting of the muscle in fevers, grow into full-formed fibres, increasing the bulk and power or restoring its losses.

The two hearts, as they may be considered—the right and left—have their general construction in common, but each has its peculiarities. Both auricles have thinner walls, and the ventricles thicker;

but the left ventricle has much thicker walls and its power is greater, as it has the task of propelling the blood through the round of the general circulation, while the right only propels it through the lungs.

The blood passes through the two sides of the heart simultaneously, coming into the right auricle from the vena cava, and into the left from the pulmonary veins. The stream of dark blood from the general system, as it approaches the right auricle, and that of the aerated blood from the lungs, as it approaches the left, are pressed upon by a vermicular contraction of the respective vessels and forced into the auricles, which speedily contract in a similar manner, forcing the blood through the auriculo-ventricular opening into the ventricles, which in turn simultaneously contract, the tricuspid valve on the right side and the mitral on the left close as the ventricles more forcibly contract, and the blood from the right is thrown to the lungs and that from the left to the general system. In the contraction of the auricles, they press down toward the openings into the ventricles and empty themselves, when they again dilate to receive the blood from the veins.

The thick layers of muscles composing the walls of the ventricles contract with great force; and from the peculiar arrangement of the fibres, some longitudinal and spiral, and others circular, the ventricles become shorter, their walls are thickened, while their cavities are diminished, the aortic and pulmonary arteries expand and elongate, the heart twists on its long axis, and the apex moves from the left and behind to the right and front; and in this act it communicates an impulse to the walls of the chest, constituting the apex beat which is felt. As this contraction gives way to relaxation, the ventricles flatten and elongate, the aorta and pulmonary artery contract and shorten, the heart turns back to the left, and the cycle of its action is completed. The contraction is called the *systole*, and the dilatation the *diastole*, and these terms when not qualified relate to the action of the ventricles.

The quantity of blood expelled from each side of the heart at each contraction is usually about the same; but as the openings on the right side are larger than those on the left, the flow is slower and not so forcible through the orifices of the right heart as through those of the left.

The calibre of the vessels near the heart is less than that of the united branches more distant, and the flow is more rapid in the aorta and vena cava than in their branches; and the same is true in regard to the pulmonary vessels.

The quantity of blood which is driven from each ventricle at each

systole is estimated to be about six ounces in a full-grown man of average size, with the usual quantity of circulating fluid.

The amount of muscle in the two ventricles is in proportion to the work each side has to perform, and as so much more force is required to carry the blood through the general system than through the lungs, the left ventricular walls are nearly three times as thick as the right.

The valves at each opening, when in the most perfect condition, completely prevent regurgitation, though a leakage through the tricuspid is perhaps a less uncommon occurrence, and is attended with less severe consequences, than one through the others.

The three semi-lunar valves at each arterial orifice lie close against the walls of the artery during the ventricular systole, and the attempted backward flow of the blood from the reaction of the arteries is prevented by the complete closure of these firm semi-lunar membranes. The auriculo-ventricular valves are supported and prevented from being washed back into the auricles on the systole of the ventricles by the chordæ tendinæ; and the muscoli papillares contract synchronously with the ventricles and aid in the mechanism which so effectually carries on the circulation every instant from the foetal state to old age.

The nutrition of the heart is carried on by the coronary arteries arising from the aorta near its commencement, and the blood is forced into them by the aortic rebound, and at the time when the coronary vessels are not pressed upon by the systole of the ventricles.

The diastole of the heart is passive, and it gains its brief period of rest and its pabulum during this relaxation and the quiet which precedes another contraction. Though these periods of rest—of sleep and renewal of excitability and strength—are short, they are frequently repeated, and in the aggregate, according to Michael Foster, they amount to about fifteen hours out of the twenty-four when the rapidity of the pulsations is not above the normal. When the heart is slowed by digitalis it has more time for sleep, and this may be among the reasons why its tonicity is increased by the action of this agent.

The *nerve supply* of the heart is a matter of much practical interest clinically, and is of not a little complexity and difficulty of understanding.

Cardiac nerves come both from the pneumogastric and the sympathetic. The pneumogastric gives off branches to the heart from both its cervical and its thoracic portions.

There are three cardiac branches of the sympathetic, which arise respectively from the three cervical ganglia; and the arrangement of all these nerves is somewhat different upon the different sides, and

there is not positive uniformity on the same side in all cases. They have various communications in their courses. They pass down, some behind and some before the subclavian artery, and in different relations to the innominate and the aorta.

Besides these supplies the heart has ganglia—centres of nerve influence of its own. This is clearly demonstrable in the heart of the frog, since it beats for a long time out of the body when kept warm and moist; and it is no doubt true that the same general laws of the heart-beat hold good in man. These intracardial ganglia perceive the impression of blood distention, and respond in an impulse to contraction.

In intimate connection with these intracardial nerve ganglia is the *vagus* nerve. This is an *inhibitory* nerve—restraining and regulating action. When this nerve is stimulated, the heart beat is slower, and when it is much excited, the action of the heart may be made to cease. When its function is diminished, the heart beats with greater rapidity, and when divided, so that its influence is destroyed, the action of the heart becomes tumultuous. It has been noticed that the right *vagus* exerts a more powerful influence on the heart than the left. The *vagus* is, however, not simple in its function. It is thought to have direct inhibitory fibres, reflex inhibitory fibres, and afferent fibres to the vaso-motor centre, connecting the action of the heart with that of the vessels.

It is probably through this channel that mental influences affect the heart; and in some very rare instances the action of the organ has been under the control of the will.

From the reflex inhibitory fibres the fainting often produced by a blow over the stomach or intestines is thought to result, and the phenomena of shock are probably brought about through these nerves.

It is thought that the strand of the *vagus* which runs up to the medulla oblongata inhibits the vaso-motor centre, so that when the heart is unduly distended with blood, the inhibitory action upon the peripheral arterioles causes their distention, the blood pressure in the arteries is diminished, and the heart is relieved by the blood flowing more freely into the vessels.

Besides, it has been found that cutting the *vagi* in animals modifies the nutrition of the heart, and in birds which survive some time the operation the heart has undergone fatty degeneration.

There are other nerve fibres passing from the medulla to the heart, called *accelerator* nerves, which, when stimulated, quicken its beat; but it is said that what is gained by this in rate is lost in force.

By these nerve arrangements the heart's actions and the actions of

the vessels are normally balanced, and the circulation is regulated and adapted to the wants of the system. By derangement of this nervous balance morbid phenomena are induced, and the harmonious rhythm may be disturbed by irritations commencing in the heart itself, or in distant parts—in the brain, and in thoracic, abdominal, pelvic, or other organs.

But the particular diseases of the heart, functional and structural, will be considered further on.

PHYSICAL EXPLORATION OF THE HEART.—POSITION, ETC.

The heart normally occupies a certain position in the chest, and maintains certain relations to other organs; and these, together with various facts of its action, are necessary to be understood with reference to the physical diagnosis of its diseases.

Various abnormalities change the position and relations of the heart, and there are slight deviations produced by the act of respiration and by different positions of the body.

Ordinarily the auricles are on a line with the third costal cartilage. The right auricle extends across the sternum to, or a little beyond, the right border. The left auricle is situated deeply behind the pulmonary artery. The right ventricle lies partly behind the sternum and partly to the left of it, and its lower border is on a level with the sixth cartilage.

The left ventricle is behind and at the left of the sternum, between the third and fifth costal interspace. Only a narrow strip of this ventricle is presented anteriorly, the greater part being covered by the right. The heart then extends vertically from the second costal interspace to the sixth rib and cartilage; and transversely from about half an inch to the right of the sternum to within half an inch of the left nipple. In narrow-chested persons the heart may extend to, or even a little beyond, the nipple, but this is not usual.

Posteriorly the base of the heart lies opposite the sixth and seventh dorsal vertebræ. The entire left ventricle, the greater part of the left auricle, and a large portion of the apex of the right ventricle are at the left of the sternum. Behind the sternum are a great portion of the right auricle and ventricle, and a small portion of the left. To the right of the sternum are a portion of the right auricle and a small part of the upper portion of the right ventricle.

Most of the heart is overlapped by the left lung, but a triangular space corresponding to the lower portion of the right ventricle is not covered by it.

The position of the valves is a matter of interest. The tricuspid

is behind the middle of the sternum, near the junction of the fourth cartilage.

The mitral is under the fourth left rib, near the sternum.

The aortic valves are behind and near the left border of the sternum, a little below the junction of the third cartilage.

The pulmonary valves are behind the junction with the sternum of the third left rib.

A circle of about an inch in diameter, with its centre at the left edge of the sternum, a little below the junction of the third rib, will include a portion of all the valves.

As has already been shown, the complete cycle of the action of the heart consists of *contraction*, *dilatation*, and *rest* of each chamber; and in this act the heart is changed in form, size, axis, and position. The systole of the ventricles constitutes the most active state of the heart, while the diastole of these chambers, though accompanied by the contraction of the auricles, is its more passive state.

The contraction of the auricles, when the auriculo-ventricular valves are open and the semi-lunar are closed, occupies but a small portion of the entire time from the beginning of one heart beat to the beginning of the next. The contraction of the ventricles, when the auriculo-ventricular valves are closed and the semi-lunar are open, occupies a longer period. According to some estimates, dividing the whole period of an ordinary heart beat, when at the rate of seventy-five per minute, into five equal parts, two fifths are occupied by the contraction of the ventricles, one fifth by their dilatation and the contraction of the auricles, and the remaining two fifths by rest. While the ventricles are dilating, and during the period of rest, no impulse is felt, no sound is normally produced, except that of the closure of the semi-lunar valves at the very beginning of the dilatation, and no manifestation of the heart's action is observed.

This rhythm of the heart is changed when the pulsations are rapid. Then the comparative period of action is greater, and that of rest is less. Thus the heart's rest depends upon the frequency, or rather the slowness of its rhythmical action. As it recuperates its forces in rest, its rapid action tends to exhaustion.

PHYSICAL EXPLORATION.

The methods of physical examination of the heart are inspection, palpation, mensuration, percussion, and auscultation.

In *inspection* the attention is chiefly directed to the form of the region, and the visible impulse of the heart. The form varies in

health, as was stated when the physical exploration of the lungs was discussed.

As the result of disease in the heart or its surroundings, there may be *bulging* as in hypertrophy, dilatation, or pericardial effusion; and though depression, as opposed to bulging, seldom or never occurs as the result of heart disease, it may be produced by the contraction of cavities in the neighboring lung.

The cardiac *impulse*, in a majority of healthy persons in a quiet state, is visible only at the apex, which is at the fifth intercostal space, on a line a little inside of the nipple. In those of a narrow chest, thin walls, and of a nervous, excitable temperament, the impulse may be seen over a space as large as the palm of the hand, and may also be observed at the epigastrium.

In others with broad chests, solid ribs, and thick walls, scarcely any movement can be seen when there is no excitement and the patient is at rest.

The visible cardiac impulse is abnormally increased by hypertrophy; still more by hypertrophy and dilatation; and especially so in young persons with elastic ribs and thin chest walls.

In the hypertrophy of the left ventricle the apex beat is carried downward and outward, often beyond the line of the nipple; and in hypertrophy of the right ventricle it is seen more toward the ensiform cartilage. Where the hypertrophy is decided, a heaving impulse may be observed over a large space, and a large part of the body may be visibly agitated by it. In simple dilatation the impulse is less heaving, less forcible, less agitating to the general system, but is often locally visible over a large space. In some cases of chorea, in exophthalmic goitre, and in various nervous palpitations, the visible impulse is greatly magnified, causing a resemblance to that of hypertrophy.

The apex beat is diminished in simple fatty degeneration without hypertrophy or dilatation, and also when the heart is covered by an emphysematous lung, and especially if there be rigid cartilages; and it is likewise diminished, but often with an undulatory motion at the base, in pericardial effusion.

The position of the apex beat may be elevated by distention of the abdomen, or by effusion in the pericardium. In the latter case the apex is tilted upward and carried outward, and may be found beating at the fourth intercostal space, behind or outside the nipple. The heart may be drawn upward or laterally, in different directions, by the contraction of a cavity in the lungs. It may be depressed by enlargement of the organ, and by the pressure of an aneurism or other tumor.

The heart may be pushed out of its place by pleuritic effusions—farther to the left, or over to the right side—and its impulse, if seen at all, will have its locality changed. The heart is rarely misplaced congenitally.

Hypertrophy gives the apex beat greater distention in length, while dilatation gives more in width. The two together produce distention in all directions.

Hypertrophy and distention of the auricles may give a visible impulse at the base of the heart—that of the right auricle in the right second intercostal space; while the same condition of the left, from disease at the mitral orifice, will sometimes produce pulsation in the left second or third space.

In pericardial effusion the intercostal spaces will bulge more, and the ribs less, than in hypertrophy or dilatation of the heart; and in pericardial adhesions, systolic retraction may sometimes be observed.

In tricuspid regurgitation pulsation of the liver may sometimes be noticed.

Observing the hue of the skin, the enlargement of the superficial veins in the region, or noticing whether there be œdema, may give some information as to the condition of the heart. Pallor will indicate arterial anæmia; blueness, venous congestion or cyanosis; and a jaundiced skin may show congestion of the liver from tricuspid regurgitation. In fatty degeneration of the heart fatty change is likely to occur in other tissues, and such change in a light skin gives a yellow tinge which might be mistaken for jaundice.

Palpation, or the application of the hand to the region of the heart, gives information of most of the conditions the eye detects, and of some others in addition. The touch is more sensitive to impulses, and many can be felt which cannot be seen. The normal shock or impulse of the heart is produced by the simultaneous contraction of the ventricles, and is felt as well as seen chiefly at the apex, and corresponds in time with the commencement of the first sound. It has a mixed, impulsive, and gliding character, free from abruptness or sharpness, comparatively brief in duration, and varying in force by the strength of the contraction and by the shape and size of the chest. In some broad-chested fleshy persons it can scarcely be felt; and it is varied by excitement and repose, and by different morbid states.

The variations of the heart beat are more readily and accurately detected by palpation than by inspection. The increase by excitement or by enlargement is readily felt. The heaving impulse in hypertrophy, and the shorter and feebler but diffused impulse of dilatation, are distinguished by the touch. The diminution of the

impulse in debility, in fatty degeneration, in rigid ribs with emphysematous lung between the heart and chest walls, the hand soon perceives. In pericardial adhesions the systolic beat may be divided and jerking, from the restraint to its free movement. According to Da Costa, "the sounds of the heart can be analyzed by means of the touch. They will be felt; the one as long and dull, the other as a short and distinct vibration." This will require some cultivation of the sense of touch; but this sense is capable, when cultivated, of making the nicest distinctions. The touch of persons both blind and deaf is an illustration. A thrill may be produced by a roughened pericardium, or by mitral obstruction, when it will be presystolic. A thrill felt at the base of the heart, if diastolic, would indicate aortic regurgitation; when at the same place and systolic, it would be evidence of aortic obstruction. An aneurism of the aorta would also give a thrill.

The distention of the right side of the heart with blood when the breath is held, and its passing away as the breathing is resumed, may be felt in thin persons, and more permanent distention may be felt in obstruction of circulation through the lungs or in obstructive disease of the heart.

The weakened and sometimes undulatory impulse of pericardial effusion, the sharp vibratory impulse of nervous irritability, a pericardial friction fremitus, and the variations of force and extent of the impulse in a combination of hypertrophy and dilatation, are all best distinguished by the touch.

There is something not readily described which distinguishes the quiet, feeble, undemonstrative action of a fatty or atrophied heart from the obviously struggling action of a heart structurally sound but dilated. (Fothergill.)

Percussion, the next named method of exploration, is used for estimating the extent of cardiac dullness. The triangular space uncovered by the lung presents an area of complete dullness. Around this, where a thin layer of lung laps over the heart, there is a border of gradually lessening dullness as the heart is more deeply covered. Over the part of the heart covered by the lung a slight tap will give more of the lung quality to the sound, but a more forcible one will give more of the quality of that over a solid organ. The whole area of the heart is proximately distinguishable by careful percussion, and its size is thus determined with sufficient accuracy for practical purposes. It is not possible, however, to be precise in this respect, as the dullness will be varied by the depth and condition of the lung covering it, as by emphysema on the one hand and consolidation on the other. The area of complete dullness is varied by inspiration and expiration, and

by the position of the body, as well as by the greater or less expansion of the lung and the size of the heart. When the heart is in an abnormal position, from any of the causes referred to which change the seat of its impulse, the position of the percussion dullness will of course be changed. The extent of the triangular portion of the heart uncovered by the lung, in a person of ordinary size and in calm respiration, is about two inches vertically, and about two inches and a half horizontally at the base. In anæmia the lungs are contracted and the area of cardiac dullness may be increased, though the heart, at the same time, is diminished in size. Changes in the size of the dull area in inspiration and expiration will indicate the freedom of play of the margins of the lung.

Auscultation is the most valuable means we possess of ascertaining the physical and dynamical conditions of the heart. By this we observe certain sounds produced by the normal action of the organ, modification of these sounds independent of heart disease, and morbid sounds dependent on heart disease; and by listening to the respiratory murmurs and the voice sounds in certain cases, our knowledge of the conditions of the heart may be aided.

In examining the heart by auscultation, the position of the patient is of some importance. In bed the patient should lie upon the back with the head raised. The sitting posture is favorable, but in making comparisons at different times, the same position should be assumed.

In cardiac examinations the stethoscope is important. It isolates the sounds, especially when a small chest-piece is used, much better than the naked ear. A change of one third of an inch in the point of listening will often make a material difference in the sound.

The heart in its rhythmical action normally produces two sounds with two periods of silence in the completion of the cycle. These sounds differ from each other in intensity, duration, pitch, quality, and in the sites where most distinctly heard; and the periods of silence differ in their duration.

With the same conditions of position, point of listening, force of action, state of exertion or rest, etc., these sounds and silences are regular and uniform in each case in a state of health.

In applying the ear to the walls of the chest in the cardiac region, the sounds heard may be imperfectly represented by the spoken words *lubb*, *tup*'. These are rhythmically repeated by a healthy heart. They should be listened to by the student until they are perfectly familiar.

The loudest and longest sound is coincident with the contraction of the ventricles, the shock against the walls of the chest, and the pulse near the heart; and it is called the *first* sound conventionally, or

the *systolic*, from its occurring with the systole of the ventricles, and sometimes it is called the *inferior* sound, from the position in which it is more loudly heard.

The *second* sound is coincident with the expansion of the ventricles, with the recedence of the heart from the chest walls, and the pulseless state of the large arteries, and it is called the *diastolic*, or, from the position where it is heard loudest, the *superior* sound.

The noiseless period succeeding the first sound is called the *first*, or *postsystolic* silence. That following the second sound is called the *second*, or *postdiastolic* silence. Dividing the entire revolution of the heart into ten equal parts, in the normal and quiet condition of the organ, the first sound occupies about four tenths, the first silence about one tenth, the second sound two tenths, and the second silence three tenths of the period. The duration of the sounds occupies about six tenths, and the silence about four tenths of the whole time of a revolution. Deviations from these proportions, when considerable, are readily appreciated.

These sounds sometimes differ much as listened to with the stethoscope applied to different parts of the heart region.

The most characteristic sound is heard near the left apex, but in an examination the stethoscope should be applied at different points in the region of the organ, and often, when listening for abnormal sounds, up and down the sternum, at the back, and elsewhere over the chest. In cases of suspected cardiac disease, extended, minute, and often repeated examinations are required, and some of the distinctions are difficult to be made; but great care and these minute distinctions are the basis of all exact observation in cardiac disease.

At the *left* apex the first sound is described as dull, measured, booming, prolonged, and distinct, with its commencement better defined than its close. It is here double the length of the second sound, is lower in pitch, and seems to be deeper seated.

The second sound is only half as long, is more clear, abrupt, flapping, and sonorous, and is more superficial and higher in pitch.

At the *right* apex there are some modifications of these sounds, but they are not great. Near the end of the sternum the first sound is clearer, shorter, more abrupt than in other situations, and of higher pitch; and the second sound is also clearer and more high pitched in this situation.

At the base of the heart differences in the sounds also occur. At the right base, opposite the second space or the third cartilage, close to the sternum, the sounds are usually louder, especially the diastolic, than at the corresponding point on the left side. Comparing the sounds at the apex and base, the systolic sounds are more marked at

the apex, and the diastolic at the base. The first or systolic sound at the base is dull and indefinite, it is shorter and has less accent, while the second or diastolic is loud and distinct, sharp and accentuated, clear, and often ringing. Deviations from these normal conditions are indicative of pathological changes.

A knowledge of the causes of these natural sounds will aid an understanding of their deviations. Into the production of the *first* sound more than one factor enters. This more prolonged booming sound is the combined result of the impulse against the walls of the chest, of the friction of the muscular fibres in the act of contraction, of the closing of the auriculo-ventricular valves, and probably of the friction of the blood current flowing through and from the ventricles. Sometimes the sound from the muscular contraction predominates, and at others that from the closure of the valves; while in others still the passage of the blood between the tendinous cords of the ventricle and along the walls and out at the openings, especially when the blood is thin, appears to give a peculiarity to the sound of the pulsation. When the muscular factor predominates the sound is more dull and muffled. When the valvular element is most distinct, the sound is more sharp and "slapping." In hypertrophy the muscular factor is most distinct, while in dilatation the thin walls emit but short muscular sounds, and the flapping of the valves as they close is distinct. In hypertrophy with dilatation the tense valves are sometimes thrown together with such force as to produce a ringing sound. The first sound of the heart then may be modified by changes in the muscular walls, by changes in the condition of the valves, and by changes in the quality of the blood. Anything which increases or diminishes the force of the muscular contractions will increase or diminish the sound of the heart beat. If the valves are thickened or contorted they will not close with the same slapping sharpness, and the sound will thus be modified. This sound is increased by excitement, is diminished in debility and in fatty or amyloid degeneration of the muscular tissue. In pericardial effusion the sound is diminished and distant, especially when the patient lies upon his back. It is also diminished when a thick pad of emphysematous lung covers it, or when there is a large amount of fat or œdematous effusion in the parietes of the chest.

It is increased when a hepatized or condensed covering of lung affords a better conducting medium for sound; or when the lung is retracted so that more of the heart comes in contact with the chest wall.

It will thus be seen that the sounds are modified not only by changes in the heart, but by different conditions of its surroundings. A tympanitic abdomen, especially a stomach much distended with

gas, will give a ringing, sonorous sound to an otherwise normal heart beat.

By disease of the heart, either structural or functional, the heart sounds may be modified in intensity, pitch, special quality, seat, and rhythm.

Hypertrophy, by increasing the muscular power and action of the heart, increases the sounds, and often very greatly.

Dilatation generally makes the first sound louder and nearer the walls of the chest, but it is often shorter, and in extreme dilatation the heart may be so feeble in its action as to produce a much diminished sound.

Induration of the walls of the heart weakens the muscular portion, but intensifies the valvular part, and changes the character of the sound.

Nervous excitement increases the first sound particularly, and makes it more quick and sharp. Anæmia causes it to be quick, sharp, and abrupt or thrilling.

Degeneration of the walls of the ventricles—softening, atrophy, or a fatty state—weakens the sound at the apex, while the valvular sounds near the base may be unaffected or even increased.

The second sound of the heart, produced by the closure of the semi-lunar valves, and dependent upon the reaction of the aorta and pulmonary artery, is increased by the increase of the blood pressure in those vessels; and any obstruction to the free flow of blood through the arteries or the capillaries will increase the blood pressure.

In chronic Bright's disease the obstructed circulation through the kidney usually causes the aortic second sound to be exaggerated.

Thinness of the semi-lunar valves shortens the second sound, and renders it more flapping and of a higher pitch.

A roughened vibratory sound may be produced by a roughened state of the endocardium; and an exocardial friction sound may mingle with a normal sound, giving it a degree of roughness.

When the motions of the heart vary in rhythm, intermit, change in frequency rapidly, or from beat to beat, the sounds will of course correspond. These changes may occur in organic disease, but are by no means evidences of structural changes; they are, however, evidences of perverted innervation. Intermittence in some forms of organic disease, especially mitral stenosis, is not unfrequent. There may possibly be only a single heart sound discoverable, the conditions of the production of one being absent; or one may be obscured or replaced by an adventitious sound.

Very rarely a reduplication of the heart sound or a double beat is heard; but there are differences of opinion as to its cause and signifi-

cance. It has been attributed to the two sides of the heart not acting in unison; to the systole of the auricles being audible; to the resolution of the first sound into its two elements, into the muscular part, the cardiac impulse, and into the valvular part, the tension and closing of the auriculo-ventricular valves; and, lastly, it has been attributed to a double effort of the ventricles, or a pause in their effort to expel the blood. It is possible that in different cases the reduplication of the sound may be due to all these respective causes. If it arises from the last-mentioned cause there would be a "wavy" condition of the pulse.

When the heart's action is tumultuous, as discovered by palpation, the sounds will sometimes be so irregular as scarcely to be distinguishable from each other.

All the heart sounds radiate more or less from their sources, and are heard with greater or less distinctness in various situations; but the seat of a sound is where it is heard loudest or is most accentuated.

The first sound of the heart is heard most distinctly near the apex, which is spoken of as its seat.

The aortic second sound, which is stronger than the pulmonary, is most accentuated at the right margin of the sternum in the second costal space; while that of the pulmonary second sound is heard most clearly at the second or third left space. When there is obstructed circulation through the lungs, a strong blood pressure in its vessels from mitral regurgitation, the pulmonary second sound is strongly developed, and is corroborating evidence of mitral insufficiency.

ADVENTITIOUS HEART SOUNDS.

The sounds we have been considering are natural sounds or their modifications. But there is another class of endocardial heart sounds which, though produced in the same localities, are more distinct from the normal and are called *murmurs*. There are certain exocardial or pericardial friction sounds which are adventitious, but which will be considered further on.

The endocardial murmurs are blowing in character, and are produced either by the flow of blood over roughened surfaces or through narrow openings, or by the meeting of two currents going in opposite directions, or by the blood being thrown with unusual force through the openings. They may also be caused by changes in the quality of the blood, as when it becomes thinner and more watery, and consequently makes more noise as it passes over surfaces of the usual character or through openings of the usual size.

These blowing sounds may then be caused by structural changes

in the endocardium or in the openings and valves of the heart, when they are called *organic* murmurs. They may be from wrong action of the heart, when they are called *dynamic*; or they may be from a thin state of the blood, when they are called *hæmic*.

The last two classes, not being dependent upon structural disease, are called *inorganic* or *functional* murmurs.

Some of the blowing sounds are persistent, occurring at each pulsation. Others are not so. The organic are more persistent, while the functional are more variable. The hæmic are *much increased* by the increased activity of the heart; and the organic are more or less affected by this increased action.

These blowing murmurs are each produced chiefly at the different openings of the heart, have particular places where they are heard most distinctly, are caused by the same actions of the heart which produce the natural sounds, and are heard at the time or near the time of these natural sounds—are synchronous, or nearly so, with either the first or second sound. They are therefore said to be systolic or diastolic; or when coming just before or just after the first sound, they are presystolic or postsystolic; or when coming just before or after the second sound, or the diastole of the ventricles, they are called prediastolic or postdiastolic. When quite synchronous with the proper sounds, they obscure them always, and often take their place, so that the natural sounds are not heard.

The particular organic changes which produce them are various. There may be contraction of the orifices, stenosis, roughness of their surfaces, and thickness of the valves; there may be excrescences upon some part of the endocardial surface, or coagula within the cavities or openings; or, what is perhaps more common, insufficiency of the valves, so that they do not completely close the openings, allowing regurgitation of the blood. Some of these conditions are more and others less serious in their consequences. Excrescences, where there is neither constriction, obstruction, nor regurgitation, and where they do not persistently increase in size, are of little consequence. Irregular attachments of the tendinous cords, throwing them across the blood currents, may cause a sound devoid of serious import. A mere roughness of the endocardial surface, especially at the orifices, as in rheumatic endocarditis, will cause blowing sounds, which may disappear as the inflammation subsides, or may become persistent when permanent structural changes follow.

The intensity and particular quality of a murmur depend upon the special conditions of the changed structures, the force of the heart's actions, and the amount and quality of the blood. Murmurs intensified by increased action may disappear when the action becomes

feeble, though the structural conditions causing them continue. Thus in fatal heart disease, sounds that have long continued may cease from failure of the heart's power near the close.

Exocardial sounds are those produced outside of the cavities of the heart, and independent of its valves and openings. They originate for the most part in the pericardium.

When this investing membrane is roughened by inflammation, by the exudation of false membrane, or by morbid growths, instead of its surfaces gliding over each other noiselessly as in health, friction sounds are produced resembling those which occur in the dry or adhesive stage of pleurisy. They may be heard in systole or in diastole, or in both. In the latter case there will be a to-and-fro sound, occurring with each cardiac pulsation. These sounds vary in intensity and character according to the condition of the surfaces brought in contact, and the force of the heart's action. They may be grazing, rubbing, or rasping; and when adhesions have formed, a creaking sound like that of a new saddle may be heard. These sounds are heard more distinctly in expiration when the lungs are comparatively empty; and when the patient is sitting or standing more than when lying on the back.

They are loudest at the junction of the fourth rib and the sternum, and are not transmitted beyond the region of the heart.

They may be distinguished from pleural friction sounds by the place of their occurrence, and by their continuance when the respiratory movements are suspended by the patient's holding his breath.

Like the pleural friction sounds, they often last but a short time in acute inflammation, as when serous effusion takes place the surfaces are separated and the friction ceases.

They may occur at the same time with endocardial sounds, but they are distinguished from them by their rubbing quality, by being more superficial, by not being transmitted along the vessels beyond the region of the heart, and by their being varied more than the endocardial by a change of position.

As before stated, the endocardial murmurs are produced mostly at the openings of the heart, by roughness or narrowing of those openings, or by diseases of the valves. They are then audible announcements that some pathological state has either roughened the lining membrane, or constricted the orifice, or rendered the valves insufficient to close the openings, allowing the blood to regurgitate. Occasionally an atheromatous or some other diseased condition, which diminishes the elasticity of the great vessels, may produce a murmur; and in all these cases the cause is organic. When from the thinness of the blood, and the irritable and somewhat forcible action of the heart, a murmur

is produced, the cause is functional; and for obvious reasons the organic and functional murmurs should be distinguished from each other.

This is not always easy, and care is required. Attention to the following points is important.

When obstructive organic disease causing blowing sounds has continued long, hypertrophy or dilatation is present. In purely functional murmurs the heart is usually of the normal size.

Functional sounds *always have their seat at the base of the heart*, are always soft in character and resemble the word *who* whispered; they are synchronous with the systole of the ventricles and the first cardiac sound, and are always produced by the blood flowing in its natural direction. They are much more variable than the organic, are produced or much increased by exercise, if hæmic; but they are sometimes relieved by moderate exercise, if dynamic or nervous.

The organic murmurs are much more common than the functional, and when the latter occur, they are accompanied with anæmia or nervous affections which present other than the cardiac symptoms. The organic murmurs vary at different times in character and intensity without material alteration in their significance.

They may change from gentle to harsh blowing, and then to grating, rubbing, and sometimes to vibrating and musical sounds, the pitch and special character varying, but indicating the same constant or slowly progressive lesion.

Having determined that a murmur is organic, the next object is to ascertain the locality and character of the lesion causing it.

There are two chief factors which lead to this determination, viz., the *time* in relation to the normal sound when the murmur is heard, and the *place* where it is heard most distinctly; and added to these are the extent and direction of the transmission of the murmur. The *rhythm*, the *seat*, and the *diffusion* of the murmur are the bases for the conclusions which are to be drawn.

There are *four* openings and sets of valves of the heart, and at each of these there are two kinds of murmurs: one produced by the blood passing in its *natural course*, called *direct*, and the other by its returning back, called *indirect* or *regurgitation*. There are, therefore, *eight* cardiac murmurs to be distinguished from each other. The direct murmurs—the blood flowing from an auricle to a ventricle, or from a ventricle into an artery—are produced by the narrowing or roughening of the openings. When produced by the blood flowing in the wrong direction—from a ventricle back into an auricle, or from an artery into a ventricle—there is an insufficiency of the valves of that opening, allowing of the regurgitation. In the first case there is usu-

ally stenosis, and in the second there is either shortening or some lesion of the valves or widening of the openings so that the valves are insufficient or incapable of closing them. There is thus a perpetual patency, and the result is obstruction to the proper flow.

The left side of the heart is much more frequently the seat of these different lesions than the right, and it will be well to consider those of this side first.

It is found by clinical observation and post-mortem inspection that murmurs produced at the mitral opening are heard most distinctly at the left apex, while those produced at the aortic opening are generally heard most distinctly at the second interspace at the margin of the sternum; while they are heard with much distinctness, but with variations in different cases, all about the base of the heart, up and down the sternum and along the course of the aorta, the subclavian, and the carotid arteries. It is not always easy to distinguish a sound produced at the aortic opening from one at the pulmonary; but the pulmonary murmur is usually heard most distinctly at the third interspace and at the left border of the sternum, and it is much more limited in its diffusion.

Having determined that the sound is produced at the aortic opening, the next question is as to whether it is *direct* from stenosis or roughness of the opening, or indirect or regurgitant from insufficiency of the valves. If heard at or about the time of the first sound of the heart, if it is *systolic* in time, it is *direct*, from the blood flowing in its natural course. If, however, it is heard at and just after the time of the second sound of the heart, if it is *diastolic*, it is indirect or regurgitant, produced by the blood flowing back from the aorta into the ventricle during its dilatation, in consequence of the insufficiency of the valves. There are other evidences that will aid in confirming these conclusions, which will be considered when the particular diseases of the heart are discussed. It is desirable that the attention of the student should here be confined to the subject of the murmurs.

Organic disease at the mitral or left auriculo-ventricular opening has its expression in murmurs. If this opening be narrowed or roughened, the blood in passing through from the auricle to the ventricle is agitated and a murmur is produced, which, occurring in the course of the flow in its natural direction, is called *direct*, and at the time of the dilatation of the ventricle it is called *diastolic*.

If, on the other hand, the valves are insufficient, when the ventricle contracts the blood is thrown back; it is agitated, and a murmur is produced.

Because the blood flows in this murmur in the wrong direction, it

is called *indirect* or regurgitant, and because it occurs at the time of the contraction of the ventricle, it is called *systolic*. The reason of this is that the position of the valve is covered by the lung, which is not a good conductor of sound; the body of the heart is a better conductor, and the apex comes nearer to the walls of the chest. The area of both the mitral-direct and regurgitant is sometimes quite limited, but at other times more diffused, and the *regurgitant* is often heard behind, near the lower angle of the left scapula.

A murmur most accentuated at the left apex of the heart is *mitral*. This being established, the question is as to whether it is *direct* from stenosis or roughness of the opening, or *regurgitant* from defect in the valves or dilatation of the opening so that the valves become insufficient. This is determined by the time of the murmur aided by the extent of its diffusion. The *regurgitant* is systolic, is produced by the backward blood-flow caused by the contraction of the ventricle, and is heard during that contraction. It is therefore heard at the time of the first sound, and when the impulse of the heart is felt against the chest walls.

The *direct* mitral murmur is produced by the blood-flow caused by the contraction of the auricle and the dilatation of the ventricle, and is heard while those processes are going on. The ventricles dilate and the flow into them continues nearly up to the time of their contraction. The murmur consequently continues up to this time, and is therefore called *presystolic*. It is often harsh in quality, and may be accompanied by a thrill. It is characterized by non-transmission, being limited in the area where it is heard. The chief difficulty in this, as in other murmurs, is to determine its time in relation to the natural sounds. This often requires close attention and care. By observing the pulsation of the heart, or, where that is confusing, by applying the finger to the carotid artery, the time of the systole may be appreciated.

The valvular diseases and murmurs of the right side of the heart, though less frequent and severe, it is important to understand. The murmurs at the opening of the *pulmonary* artery are seldom rough or loud, are superficial, and are most intense at the second left intercostal space, close to the sternum. The *transmission* is in an upward direction and toward the middle of the clavicle, but is not extensive, the area in which the sound is heard being much more limited than in aortic murmurs. The pulmonary murmur is almost always heard at the time of the first sound of the heart, and is therefore *direct*. It is often hæmic, and then will be combined with a similar sound at the aortic opening.

Regurgitant pulmonary murmurs are extremely rare, but they

would be heard in the same situations as the direct, and at the time of the second heart sound.

The *tricuspid regurgitant*, or *systolic murmur*, like the mitral, is produced by insufficiency of the valves concerned, which is not an unfrequent condition. This systolic murmur is heard over the ensiform cartilage and toward the right side. It is seldom transmitted very high up, is generally of a blowing character, is accompanied with pulsations at the epigastrium, and often of the liver, and it frequently complicates severe cases of prolonged pulmonary disease where there is obstruction of the pulmonary circulation. Such obstruction is likely to dilate the right side of the heart and to render insufficient the tricuspid valves.

The following *synopsis* of *cardiac murmurs* may aid the student in recalling and fixing in the mind some of the statements which have been made. Regarding the time at which murmurs are heard, they may be divided into three classes :

1. Systolic. 2. Diastolic. 3. Presystolic.

1st. *Systolic murmurs*.—A murmur whose *site* is at the second right interspace near the base of the heart, and which is transmitted along the aorta and up and down the sternum, if organic, indicates stenosis or some form of obstructive disease at the *aortic* opening.

One, the site of which is at the second or third left interspace, transmitted toward the *left clavicle*, if organic, indicates obstructive disease of the pulmonary opening.

A systolic murmur with its site at the apex, transmitted to the left axilla and back to the lower part of the scapula, is evidence of *regurgitation* and of insufficiency of mitral valves.

A systolic murmur whose *site* is at the lower sternal region and at the right apex, transmitted to the right of the sternum, indicates regurgitation and patulency of the tricuspid valves.

2d. *Diastolic murmurs*.—A diastolic murmur with its *site* at the second right interspace at the border of the sternum, and transmitted chiefly down the sternum, commencing with or near and continuing after the second sound, is *regurgitant* and indicates *insufficiency* of the *aortic valves*.

A similar though gentler sound heard at the second or third *left* interspace, transmitted to a less extent, but probably in the same direction, would indicate *regurgitation* and consequent insufficiency of the *pulmonary valves*.

3. *Presystolic murmur*.—Of this class there is but one well-marked specimen. Its site is at the left apex, it is not specially transmitted in any particular direction, and it indicates obstructive disease at the mitral opening.

Different lesions, and consequently different murmurs, may exist at the same time. For example, disease at the mitral opening may cause contraction of the orifice and insufficiency of the valves, producing at each cycle of heart beat both an obstructive direct and a regurgitant indirect murmur, and the same may be the case with any of the openings. Moreover, complications may result from the simultaneous occurrence of disease at different parts, and in some cases a complete diagnosis is difficult.

The preceding statements, introductory to an account of the particular diseases of the heart, have been extended to a greater length than was intended, but they have seemed essential to a satisfactory presentation of the subject.

It must be acknowledged that not a few practitioners and students do not provide themselves with special works on the heart, and fail to master the subject of its physical exploration; and it is hoped that by thus presenting the more essential facts in a general work on the practice of medicine, they will receive that portion of attention which their importance demands.

PARTICULAR HEART DISEASES.

The special diseases of the heart are conveniently divided into organic and functional.

The organic diseases may again be divided into inflammatory affections, and more decided structural lesions, the results of various morbid processes. The functional affections are for the most part neuropathic, and may be dependent upon diseased conditions of the nerve-centres, of the nerves supplying the heart, of the ganglia within its substance; or they may depend upon disease of distant organs disturbing its functions through sympathy.

Inflammation of the heart and its appendages will first be considered, then its other structural lesions, and afterward its functional derangements.

ACUTE PERICARDITIS.

This is an acute inflammation of the serous membrane forming the shut sac which envelops the heart.

The essential *Anatomical Character* of this is the same as that of inflammations of other fibro-serous membranes, a general description of which has been given. This inflammation may be limited, or more diffused over the pericardial surface. When circumscribed it is oftenest at the base of the heart and about the origin of the great

vessels. In the severer forms and in a majority of cases it involves a large part of the membrane. In the early stage it is hyperæmic and often ecchymosed in spots, is roughened by enlargement of the vessels; and generally exudates appear, serous, corpuscular and fibrinous, or purulent, according to the grade of the inflammatory action and the condition of the system. These different exudates may be mingled together in various proportions. When the exudate is nearly all fibrinous and corpuscular, the pericarditis is called *dry*; and when it consists chiefly of serum, it is called *effusive pericarditis*. The serum is sometimes deeply colored with blood, when it is hemorrhagic; and in cases of pyæmia especially it may be suppurative. In the fibrinous variety the exudate is usually deposited in layers, and often becomes more or less organized; and by the constant motion of the heart it is usually drawn into projecting points, which give it a rough, shaggy appearance, strongly resembling "tripe." When this lymph becomes organized into a well-formed adventitious tissue, adhesions occur, and by the contraction of this false membrane the action of the heart may be much embarrassed. In some cases the adhesions are imperfect, consisting of bands, and the motion of the heart is less restrained.

The inflammation, usually commencing upon the cardiac portion of the membrane, about the base and septa, soon extends to the free portion of the sac, and sometimes involves its whole tissue and attacks the adjoining pleura.

The most frequent result of an acute attack is an effusion of serous fluid. This may increase rapidly. At first it falls into the back part of the sac, but as it increases in quantity it distends the cavity in every direction, displacing the lungs, and pushing the diaphragm downward. At first, as it occupies the most depending part of the sac, the heart is tilted upward, and the apex beat is felt behind or above the nipple.

It is stated by some that, instead of the apex being raised, it is removed from the chest wall by the interposition of the fluid, and the impulse of the upper border of the left ventricle is felt in a position higher than the ordinary apex pulsation. When the quantity of fluid is very great, the whole heart is removed from the walls of the chest, falling backward when the patient lies upon the back, and its impulse can scarcely be felt in any position. The fluid, according to its amount and the unyielding character of the sac, compresses the heart and the vessels at its base, thus embarrassing the circulation.

In favorable cases, as the inflammation abates, the fluid is absorbed away; but as it often has mingled with it fibrinous matter, this may remain, forming bands and partial adhesions; and in the dryer forms,

or from repeated attacks, or in cases where the inflammation lingers, the adhesions may be so extensive as to obliterate the cavity of the sac.

By the subsequent contraction of the false membrane the heart may be so much embarrassed in its movements as seriously to interfere with the circulation.

Sometimes calcareous deposits take place in the organized adventitious tissue, and in rare cases so extensively as to give the appearance of a bony shell inclosing the heart.

The muscular tissue of the heart is apt to be involved from the close connection of the pericardium, adding to the embarrassment of its action. It should, however, be mentioned that pericardial adhesions do not always interfere with the action of the heart. Cases are found *post mortem* of old extensive adhesions, where symptoms of cardiac obstruction had not for a long time previous attracted attention. When, as is often the case, valvular lesions are present, the symptoms are much more likely to be due to them.

Not unfrequently "white patches," or "milk spots," are found upon the surface of the heart. In size they are about half an inch, more or less, across, and have a thickness of from half a line to one or two lines. They occur under a variety of circumstances, and have something of the appearance of false membrane, but should be distinguished from it; the epithelium is perfect, and they are regarded as comparatively innocent growths of white connective tissue of no great importance. These spots are not the result of decided inflammation, and are not known to have any symptomatic manifestations.

Complications and Varieties.—Like other serous membranes the pericardium may be the seat of gray miliary tubercle, accompanied with inflammation and effusions.

There are several varieties of pericarditis, depending upon the causes that produce them and the conditions of the system in which they occur. The disease most frequently occurs in connection with rheumatism, and is, in fact, a rheumatic inflammation of this fibrous structure. Modified in some respects from rheumatic inflammation of the joints, it is of the same general character. It usually subsides with the disappearance of the rheumatic fever; the exudations, which are chiefly serum, but with some lymph intermingled, are commonly soon absorbed away, and the results of rheumatic pericarditis are seldom serious. Rheumatic endocarditis, from the changes it produces in the openings and valves of the heart, is much more grave in its consequences.

Opolza makes four forms of pericarditis, viz.:

1. Idiopathic or simple, unconnected with morbid constitutional

conditions, sometimes traumatic and sometimes arising from the common causes of simple idiopathic inflammation. This form is rare.

2. Consecutive, where it follows pleurisy, disease of the sternum or ribs, tubercle of the lungs, etc.

3. Symptomatic, where it is a part of a general diseased condition, as rheumatism, Bright's disease, scarlatina, scurvy, purpura, or syphilis.

4. Metastatic, where, as in septic conditions, pyæmia, or puerperal fever, the poisons in the system reach this membrane, and a low inflammation and purulent exudates occur.

Pericarditis has occurred as an epidemic in Russia, among the illy-fed people along the shores of the Baltic.

Symptoms.—The *symptoms* and *course* of the disease will vary as it occurs under different circumstances.

In rheumatic fever the symptoms are often obscured by the general disease. There is usually pain in the region, but often that in the joints is so much more severe as to divert attention from the cardiac suffering. When effusion takes place, as it frequently does in a few hours after the pericardial attack, the pain is usually inconsiderable and not unfrequently absent; and as the fever which is present is accounted for by the disease of the joints, the embarrassment to the circulation and the respiration, which in moderate cases may be slight, is likely to be attributed to the same cause. The physical signs are chiefly to be depended upon for distinguishing the presence of the pericarditis. There is, however, a sense of depression and suffering, and a plaintive look of helplessness and appeal for aid, which is not usually present when the heart is unaffected. The action of the heart is more accelerated; the impulse, before considerable effusion, is sharp and abrupt, and the second sound especially is clear and ringing, and there is often a rustle accompanying the beat. The palpitation and apparent excitement soon give way to appearances of cardiac debility. There may be headache, dizziness, and a tendency to delirium. The temperature is increased, but not usually above 104° F., and it may be due to the general rheumatic condition. Sometimes in the latter stages the temperature is low. There is often derangement of the stomach, from the connection of the nerve supply. The urine is scanty and abounds in urates, and may be albuminous.

As the rational symptoms in rheumatic pericarditis are not markedly distinctive, the physical signs should be carefully observed; and, in severe rheumatic fever, the heart should be daily examined.

Signs.—On inspection in the early stage, before much effusion

takes place, no characteristic signs are presented. Neither is there anything distinctive on palpation or percussion.

On auscultation, as already stated, the sounds are at first distinct and often sharp, and a rustling is heard aside from the distinctive friction sound to be mentioned. The roughened state of the pericardium presents a grazing friction sound, which may be either systolic or diastolic, or both, and when of the latter character it is called a to-and-fro sound. It is confined to the region of the heart, is grazing and superficial, while the membrane is simply roughened by the distended vessels; and when the serous effusion takes place, the surfaces for the most part are separated from each other and the friction sound ceases.

As the effusion increases, on inspection and palpation the region in a young subject with yielding ribs may be found bulging, and the visible and palpable heart beat will be higher in the chest, and an undulatory motion sometimes is perceived near the base. When the effusion becomes large the impulse may not be perceived, especially when the patient lies upon his back.

Now the area of dullness on percussion is increased, and may become extensive. Enormous accumulations sometimes take place in chronic or subacute cases, the line of dullness extending beyond the sternum on the right, and far beyond the nipple on the left.

Auscultation now shows the sounds to be feeble and distant, and they are sometimes lost, especially when the patient lies upon his back. When leaning over forward, the heart gravitates to the anterior walls of the chest, and its sounds may then be heard. Adhesions are not always discernible, though when they are loose a peculiar, somewhat rumbling, noise may be heard, and sometimes when the adhesions are more firm, a creaking sound, as of a new saddle, may be perceived. When contraction takes place, the embarrassed condition of the heart may be discovered.

When there is a free pericardial effusion, the lung is of course pressed upon and condensed, sometimes removed from a large area; while if adhesions of the pericardium and pleura have occurred, the lung may continue to cover much of the space, giving its sounds on percussion and auscultation, and concealing the extent of the effusion. On the other hand, if the lung is much condensed, the extension of the dullness may be greater than would be produced by the pericardial effusion. In such cases bronchial breathing and vocal fremitus would be likely to be heard over the condensed lung, but not over the distended pericardium when the lung was pushed aside.

When the effusion is absorbed, and the roughened pericardial surfaces are again brought in contact, friction sounds will return. They

are then more persistent and often more marked and characteristic than at first. As the heart in all its parts can scarcely be said to be at rest at any one time, the friction murmurs will extend into the interval between the normal sounds, and sometimes occupy the whole revolution of the cardiac movement. It has then received the name of "*bruit de galop*."

When the function of the heart is seriously interfered with, either from the weakness of its muscular walls, the pressure of the effusion, or the contraction of the adhesions, the whole venous system becomes congested; the functions of the lungs, brain, kidneys, liver, alimentary canal, etc., will be disturbed; dyspnœa may be great; headache, vertigo, and other brain symptoms may be induced; albumen may appear in the urine; a jaundiced condition may supervene, and general dropsical effusions usually take place.

Irritation of the pneumogastric and other nerves may cause a variety of disturbances of the heart's actions, and those of other neighboring organs.

In these severer cases without relief, the dropsical accumulations may become great, or before there is time for that, the functions are depressed, the temperature falls, the pulse becomes exceedingly feeble and irregular, and death closes the scene.

Prognosis.—The *course*, *duration*, and *termination* of pericarditis will vary much in different cases, as will be inferred from what has preceded.

In simple acute cases, and in most rheumatic cases, the inflammation will subside and the effusion be absorbed in from one to two or three weeks.

In the favorable cases, as the absorption goes on, the apex beat returns to its normal position; the dullness on percussion gradually diminishes; the natural sounds regain their normal character; the friction sound returns, but before long ceases, and the normal condition is restored. If adhesions take place, they are not speedily removed and may become permanent, with more or less morbid consequences according to their character and extent.

Those cases dependent upon puerperal septicæmia, or pyæmia, are far more likely to be unfavorable, and when fatal are shorter in duration, than those dependent upon rheumatism. In scorbutic and hemorrhagic cases, a fatal termination may be very speedy; and this may be the case when inflammation extends from the pleura to the pericardium and heart. In Bright's disease, pericarditis may come on gradually and assume a chronic form. It is almost always persistent, as the disease upon which it depends, when sufficiently advanced to produce this effect, is persistent and progressive.

The *prognosis* of pericarditis, then, will depend upon the causes producing it, and the morbid states with which it may be associated. In simple and rheumatic cases it is favorable.

Coming on in the course of various grave diseases, it is very unfavorable.

As a complication of scarlatina, pyæmia, septic puerperal diseases, Bright's disease, small-pox, and some other eruptive fevers, or of pneumonia and pleuritis, it is very often fatal.

Diagnosis.—The differential diagnosis of pericarditis is not always easy. It is particularly to be distinguished from endocarditis, hydropericardium, myocarditis, and pleurisy of the left side.

The separation of endocardial and exocardial murmurs is sometimes a matter of difficulty. A more particular comparison will be made after describing endocarditis.

Dropsy of the pericardium without inflammation is to be distinguished from pericarditis by the absence of fever, of local pain, and of preceding friction murmurs, and often by the presence of other dropsical effusions.

It may be distinguished from pleurisy in the early stage by the following signs: The pain is not aggravated in the same manner by respiration; the friction sound is synchronous with the heart beat, and is not arrested by holding the breath; and when effusion takes place the line of dullness is not materially changed by change of position of the body; and the dullness, except in extreme cases, is not perceived at the back of the chest. In pleuritic effusion all breath sounds disappear posteriorly and anteriorly where the fluid is situated. In pericardial effusions the sounds do not disappear except as the lungs are pushed aside by the distended pericardium. A pleuritic roughness and friction, when in contact with the heart, will not be dependent upon respiration, but upon the heart's motion, and cannot be distinguished from pericardial friction sounds.

Hypertrophy and dilatation of the heart present a larger space of dullness than normal, and sometimes a degree of bulging, and in that respect may resemble pericardial effusion; but the heart sounds and the violent and heaving impulse in hypertrophy will distinguish it from effusion; and in dilatation, though the distinction is not so well marked, the impulse is greater and the heart sounds more distinct, the apex beat is lower and farther to the left, and the history of the case will be different from that of pericarditis.

Certain other phenomena sometimes occur in acute pericarditis, which involve other organs and may aid in the diagnosis. There is sometimes great difficulty of breathing, and lying down is impossible. Irritation or pressure upon the pneumogastric and other nerves may

produce a variety of symptoms, not only irregularity of the heart's actions, but disturbance of the stomach, and of the action of the diaphragm. There may be spasms or paralysis of that muscle.

Rarely pericarditis simulates acute meningitis. This may present great difficulty in diagnosis, as in rheumatism, where pericarditis more frequently occurs, the rheumatic inflammation may attack the membranes of the brain. Indeed, in pyæmia and Bright's disease, as well as in rheumatism, the same poison in the blood which affects the pericardium may at the same time affect the cerebral meninges. Dr. Flint regards the patient's delusion that he has committed some crime, as a frequent if not a distinguishing feature of pericarditis simulating meningitis.

The nature of the effused fluid in pericarditis, unless some is obtained by exploration, can only be inferred from the history of the case and the concomitant conditions. In septicæmic and pyæmic cases the fluid is likely to be purulent. In scorbutic cases it is likely to be bloody. When inflammation extends to the pericardium in suppurative pleuritis, it is apt to be purulent. It scarcely needs to be said that these fluids are not so easily disposed of as serum, or that these cases are exceedingly dangerous.

Treatment.—The treatment will be influenced by the class of the disease to which the case belongs. In simple pericarditis, arising from injury or a cold, the usual antiphlogistic remedies, as in cases of pleurisy, will be indicated.

The question of bleeding will present itself, but unless the patient is decidedly plethoric, or there be much congestion of the venous system from obstructed circulation through the right side of the heart, venesection should be avoided. Diminishing the quantity of the blood when excessive will diminish the labor of the heart to keep it in circulation; and when cerebral or hepatic congestion is great, relief will follow the use of the remedy. It, however, should be borne in mind that the greatest danger is from failure of the heart's power, and that any treatment which permanently diminishes that power is at least unsafe, though affording present relief. Hence the above statement is the safest guide.

Nothing would be more likely to arrest the disease in the early stage than a scruple of quinine with half a grain of morphine, given at once, or in two or three doses repeated in from one to two or three hours, with the full effect kept up for twenty-four hours or more by additional but smaller doses. The quinine, as a rule, should then be discontinued, but may be again resorted to in two or three days if acute symptoms continue. When effusion has taken place, this should receive attention. Eliminatives are now demanded. Cathartics pro-

curing watery discharges, saline diuretics, and various diaphoretics are indicated on rational principles, and often do much good.

Mercury formerly had much reputation as a sorbefacient and as diminishing the plasticity of exudates, and it still maintains its reputation with some, while it is the fashion with others to deny its efficacy for such purposes. That it has virtues of this kind seems at least probable, under some circumstances I may say seems certain; but its curative effects in pericardial effusions are not sufficiently demonstrated to justify its use to the extent of producing spanæmia and the protracted debility which may follow. At a later stage the iodide of potassium is called for, and may be used freely for a considerable time. It is generally well borne, and may be combined with other remedies, such as the conditions may indicate. Fothergill says: "Free purgation, warm baths, and the exhibition of iodide of potassium with infusion of buchu, are to be relied upon to procure absorption of the fluid. The salts of ammonia, acetate, hydrochlorate, and carbonate, appear to have an influence in lessening the coagulability of fibrinous exudates, and five grains or more of the carbonate given in a solution of the acetate, once in two hours, is strongly recommended."

In sthenic and active cases leeches may be applied to the cardiac region, or, if there be debility, dry cups will be useful. After these means, ice-bags to the part when the action is high are recommended; but this remedy should be withheld when the action of the heart is feeble, or after much effusion has taken place. I do not doubt the good effects of blisters when the effusion has occurred. Remedies which diminish the excitement of the heart and the rapidity of its action are also often useful.

The quinine and morphine will often be effectual in accomplishing that object, but tincture of aconite or of veratrum viride, before the power of the heart is much impaired, may likewise be of service. When the heart begins to flag in force, digitalis should be substituted, and that with the ammonia salts, or other diuretics, will not only conserve the power of the heart, but promote absorption of the fluid. Jabourendi, or its active principle pilocarpin, in sufficient doses to produce its full diaphoretic effect, may be given when the heart is not too weak, as it has a decided tendency to prevent effusion or to cause absorption when effusion has occurred.

When the action of the heart is depressed, the pulse weak, and a tendency to syncope exists, all depressing agents must be discontinued and quinine in moderate doses, ammonia, ether, camphor, alcohol, and other like remedies are indicated. Digitalis, properly regulated as to the dose, may be continued, and beef-tea and other suitable

nourishment should be given. Warm coffee, from time to time, will sometimes act more efficiently as a cardiac stimulant than many other articles more frequently prescribed.

When the quantity of fluid is excessive, and other measures have failed to remove it, the *aspirator* may be resorted to, often with the greatest advantage. The hypodermic syringe may be used to determine the character of the fluid, and if it be purulent, the necessity of its mechanical removal frequently becomes imperative. The needle of the syringe or the aspirator should be inserted in the fifth intercostal space, and not far from the left border of the sternum. The operation is not without its dangers and disadvantages. Air may be introduced into the pericardium, without proper care the heart may be wounded, a hemorrhage into the cavity may be induced, the sac may speedily fill up after the pressure of the fluid is removed, and where there is extreme debility the patient may not bear well the loss of the serum of the blood, which the operation, if repeated, may cause.

Of sixty tabulated cases of paracentesis of the pericardium, twenty-four recovered; and of the thirty-six that were fatal, twenty-three survived the operation one day or longer, the average duration of life being over twenty-seven days. Danger, therefore, from the immediate effects of the operation is not great.

To avoid wounding the heart the patient should lie upon his back when the operation is performed; the instrument used should be a small-sized trocar rather than the common needle of an aspirator, as when the stylet is withdrawn the canula will not puncture the pulsating organ, and better effects are realized when the fluid is drawn off slowly, and perhaps but a part at a time.

Where the effusion returns repeatedly, and the case has become chronic, it is alleged to be safe practice to inject the tincture of iodine of the strength of half a drachm to the ounce of water; or, in cases of purulent effusion, a drachm of iodide of potassium, it is said, may be added to each ounce of the above mixture, and three or four ounces may be injected. I fear experience has not been sufficient to prove this treatment safe, and I would prefer to use a milder injection, at least at first.

The permanganate of potash, of the strength of a grain or two to the ounce, might be safer and yet efficient. Its effects in suppurative pleurisy have been tested, and it may probably be safely used in suppurative pericarditis.

These measures are admissible only when repeated accumulations have occurred in chronic cases, and sometimes the opening may be permanent and a drainage tube inserted.

During convalescence from acute pericarditis, undue excitement of the heart by exercise, mental emotions, free quantities of food, hot or

irritating drinks, etc., should be carefully avoided. A nourishing but easily digested diet, riding rather than active exercise out of doors, and the observance of hygienic measures, and sometimes the use of tonics, will promote recovery.

Rheumatic pericarditis, as already stated, is the most frequent form of the disease. The phenomena are not materially different from those which have been described under the head of simple pericarditis, and in fact this form of the disease was held in view in the description given.

The *treatment*, however, will be somewhat modified by the rheumatic condition. In fact, rheumatic pericarditis is the same sort of inflammation as rheumatic arthritis, and requires to be treated in a similar manner. The heart, unlike a joint, cannot be kept at rest, and indeed, when it is failing, digitalis and other means must be used to keep it in action. This is the chief difference in the two cases.

The efficacy of salicine, salicylic acid, and salicylate of soda in acute rheumatism is now well established; and these remedies should be thoroughly tried. The method of their use was sufficiently described in the article upon acute rheumatism. Opiates and other agents may be combined as the particular symptoms, and especially the activities of the heart, may require.

The alkaline remedies here, as in other cases of rheumatism, may be called for, and in short the rheumatism should be treated, and special remedies should be used for the heart, according to its conditions.

Dr. Fothergill is much in favor of wrapping the patient in flannel, scrupulously avoiding any exposure to cold, and applying hot poultices over the region of the heart, with a few thicknesses of flannel interposed; and if the weight of the poultices cannot be borne, he advises wrapping the chest in cotton-wool. Opium, he thinks, may be given with comparative freedom.

Pericarditis, the result of pyæmia and Bright's disease, will require treatment adapted to those conditions.

Those diseases will furnish the leading indications, while special palliative measures may be addressed to the conditions of the heart. These will be suggested by the symptoms.

CHRONIC PERICARDITIS.

Subacute and chronic inflammation of the pericardium following acute has already been noticed. Occasionally the disease is subacute or chronic from the beginning. The anatomical character of these

cases differs. In some there is no liquid effusion ; but plastic exudations occur and adhesions take place with a low grade of inflammation continuing.

In others serous effusions are poured out, slowly it may be, but persistently, and sometimes the accumulations are enormous.

In both cases, where adhesions or where liquid effusions occur, the functional disturbances and the physical signs are similar to those which follow acute attacks, with the same ultimate results. As these chronic cases are apt to be diathetic, the *prognosis* is more unfavorable.

The indications of treatment will largely depend upon the diathesis. Rheumatism, gout, Bright's disease, scorbutus, tuberculosis, alcoholism, etc., will receive attention, while the conditions of the heart, general states of depression and debility, will require appropriate measures. For the effusions and exudates, diuretics, iodide of potassium, blisters, or iodine liniments may be tried. Cathartics are to be used continuously ; but if the strength will allow, the milder hydragogues will often afford much relief by diminishing the effusion.

Paracentesis here, as in the cases following acute attacks, may be applicable and necessary, but when diathetic diseases are at the foundation all means are likely to prove powerless to effect a final cure.

Pneumopericarditis and *pneumopericardium* are terms expressive of air or gas in the pericardium, the first with, and the last without, inflammation. These conditions are rare, but possible, and Müller has collected an account of twenty-eight cases, nine of which terminated in recovery.

Air may find its way into the cavity through wounds of the chest, through fistulous openings from the lungs, the œsophagus, or the stomach ; and gases may possibly be produced in the cavity by decomposition of materials within it.

The presence of air and liquid would give rise to splashing sounds from movements of the heart ; and percussion over the præcordia would elicit tympanitic resonance.

The treatment of pneumopericarditis is to be conducted on the same principles as in cases of inflammation without the presence of gas or air ; though reference must be had to the conditions accompanying it. Those produced by wounds of the walls of the chest are most favorable. Out of fourteen such cases six recovered.

PERICARDIAL ADHESIONS.

Pericardial adhesions have been referred to as results of pericardial inflammation. The clinical history of such cases is obscure, and only

when the adhesions involve the costal pleura are there objective evidences of their existence. Simple adhesions may of themselves be accompanied by no subjective symptoms; but where contraction is great or irregular in different situations, or accompanied by other lesions, there will probably be evidence of heart failure, such as dyspnœa, readily aggravated by exertion, venous congestion, visceral fullness and congestion, dropsy, and sometimes paroxysms of severe pain. Symptoms of this kind following pericarditis will become presumptive evidence of adhesions and their consequences, when other changes of the heart are excluded.

When there are adhesions to the pleura, the heart may be drawn from its normal position, the apex may be elevated or depressed, and may be fixed in an unnatural position, and the area of dullness on percussion may be unchanged by inspiration or expiration. If this latter condition was present, and there was retraction or pitting of an intercostal space at the point of the apex beat, and at the time of a ventricular systole, the fact of adhesion would be satisfactorily determined.

The prognosis would be hopeless as to cure, and when severe symptoms were produced, it would not be favorable as to long continuance of life; but, as before intimated, the unfavorable result would generally be due to concomitant morbid conditions accompanying the adhesions.

The treatment would be symptomatic, as when adhesions are firmly formed we have no reliable means of breaking them up.

HYDROPERICARDIUM.

This is a collection of watery fluid in the pericardium, independent of inflammation.

It is a serous effusion usually accompanied with cardiac failure, with Bright's disease, or with the results of scarlet fever. The fluid contains some albumen, but no lymph, and when absorbed away leaves no solid material behind. The amount, usually, is five or six ounces, but may be much more or less; and when below an ounce it should not be regarded as pathological.

The effect of this fluid upon the heart is to embarrass its action by compression, while the heart fibres are infiltrated, become pale, and often are more easily torn.

Besides being produced by scarlatina, Bright's disease, and chronic heart affections, it may be produced by a general dropsical tendency from other causes; it may occur from tubercle of the pericardium

without any marked inflammatory process, and Niemeyer thinks it may occur from diminution of the size of the heart, thus diminishing the pressure in the pericardium, and leading to effusion.

The Symptoms are those of cardiac embarrassment, and there will be evidence of the general dropsical state of which it is a part.

The physical signs are the same as those from pericardial effusion as the result of inflammation.

The Prognosis will depend upon the associated conditions. When it occurs as the result of scarlatina, the prognosis is more favorable. In organic heart disease it usually occurs late, and is ominous of a speedy end. So in Bright's disease, in tubercle, and in other dyscrasias.

It is to be distinguished from inflammatory effusion by the history of the case and the concomitant symptoms.

The Treatment will be that of the conditions upon which it depends.

In post-scarlatinal cases hydragogue cathartics, warm baths, diaphoretics, and, sometimes, diuretics will be indicated. In chronic kidney diseases, the treatment should be as hereafter described. In chronic heart disease, digitalis is often doubly indicated, for strengthening the heart and eliminating by the kidneys. In each case the treatment must be governed by the particular conditions present.

Hæmopericardium is blood in the heart sac, and usually is the result of wounds or of rupture of the heart. These are generally of a character to prove fatal, but not necessarily so; and after a rupture the patient may live some days. The result, however, is usually speedy, and the cases scarcely admit of treatment. Perfect quiet, with such symptomatic management as may seem indicated in the cases not speedily fatal, will be required.

Wounds of the pericardium and heart, when not too extensive, have been recovered from. Inflammation, as from other wounds, will follow, and must be met by rest, anodynes, and other means as may be indicated.

ENDOCARDITIS.

Endocarditis is an inflammation of the endocardium, or internal lining membrane of the heart.

This membrane has two layers of fibrous tissue, the outer one having many elastic fibres, some smooth muscular fibres, and flat branching cells; and it is connected with the muscular walls of the heart by a layer of common fibrillated connective tissue. This mem-

brane is covered upon its free surface by a single layer of flat cells called the endothelium. Capillary vessels pass from somewhat larger vessels in the fibrillated connective tissue into the elastic coat, and nearly reach the endothelium. The valves of the heart are constituted of folds of the endocardial membrane, strengthened by an additional fibrous layer, projected between the folds from the fibrous rings of the openings which these valves serve to close. The valves are well supplied with capillary vessels extending from the central fibrous layer into the elastic lamellæ beneath the endothelium. These valves are more subject to inflammation than the rest of the endocardium, though the portion covering the chordæ tendineæ is a frequent seat; and the results of inflammation in the valves are much more serious than in other parts of the membrane.

The inflammatory lesions do not affect the free edges of the valves as much as the thickened parts a little distance from them, and the base of the valve is quite subject to inflammatory action.

Inflammation of the endocardium may be divided into simple endocarditis, which may be acute, subacute, or chronic; and a destructive or ulcerative form, sometimes with diphtheritic deposits.

Endocarditis, in one form or another, is not an uncommon disease, and is serious in its remote rather than in its immediate consequences.

It is rarely observed as a strictly idiopathic affection, but is most frequent in acute rheumatism; sometimes it occurs in scarlatina, more rarely in other exanthemata, not very unfrequently in Bright's disease, and occasionally in typhoid fever. The more destructive forms are found in cases of pyæmia and septic poisoning.

It will be observed that it occurs under the same conditions as pericarditis, and the two affections are often associated together. There seems to be a connection between endocarditis and an acid condition of the blood. It has been found to follow the administration of lactic acid; and in rheumatism, lithiasis, and pyæmia, acids are said to be present in the circulating fluid. It may occur without being detected, and from other causes than those named, as sometimes its results are found where there has been no history of its ordinary appearance.

Pathological Anatomy.—The appearances vary in different cases. In the first stage there is injection of the vessels, which must not be confounded with the mere staining of the membrane, which is often found where no inflammation has occurred.

In inflammatory hyperæmia the blood is seen to be in the twigs of vessels, though it may at the same time be effused into the tissue.

Young cells are found in the membrane, which loses its lustre and is swollen.

The valves are thickened often to their free edges, and contain cells and fibres. On the surface of the inflamed membrane are very often found vascular growths or villi, frequently aggregated together, giving the surface a warty appearance. When this appearance is marked, it has been called verrucous or papillary endocarditis. In other cases a sclerotic or hardening and contracting process is found, the valves especially having become thickened and shrunken.

Fœtal endocarditis has been observed, and it is generally confined to the right side of the heart; but after birth it is almost exclusively confined to the left side of the organ. Exudations doubtless take place from the inflamed surface, but they are usually washed away in the current of the blood, and are seldom found adherent to it. However, they are sometimes adherent; and not unfrequently fibrinous masses after for a time adhering are detached from the valves or the chordæ and borne away to form emboli, which may lodge in any of the organs, and perhaps more frequently than elsewhere in the left middle cerebral artery.

The warty excrescences are often aggregated together, forming masses of the size of a pea or larger. These vegetations are of different shapes, and may be attached by a broad base or a slender pedicle.

They are real outgrowths from the membrane, and not merely fibrinous deposits, as was once supposed; yet in connection with them fibrinous and cellular deposits may take place. The vegetations as well as the deposits may break off and form emboli. This, and other destructive inflammatory processes, may result in perforation of the valves; and distentions of these thin membranes are sometimes found.

Morbid processes may extend to the muscular tissue of the heart, leading to weakening of the part and dilatation of the cavities; and when decided at a particular point, bulging, or a cardiac aneurism may follow. The papillary muscles are sometimes involved in their entire structure, and this may lead to their weakening and elongation, so that they fail to hold the mitral valves to their places, and these are washed back into the auricles in the ventricular systole.

When endocarditis has assumed subacute and chronic forms, the vegetations or excrescences become more fibrinous and firmer in texture. The valves become much deformed by contraction of deposits within them. The chordæ tendineæ are often shrunken and thickened. Adhesions of the valves to each other, or the heart walls, are often found. Fatty degenerations, and calcifications of the vegetations and the thickened endocardium are frequently observed: contraction of the openings is seen, and roughness, stenosis, and insufficiency result.

Clinical Phenomena.—Endocarditis occurs most frequently in

acute rheumatism; often in connection with pericarditis, and its rational symptoms are frequently obscure.

It seldom gives rise to much local pain, and when this symptom is present, it is more likely to be produced by pericardial inflammation. There is fever, but that is produced by the rheumatic condition of which the endocarditis is a part.

There is, however, a sense of precordial distress greater than occurs where disease of the endocardium is absent; the heart's action is more frequent and may be more feeble, and when more feeble the inflammation extends to the muscular walls; but, on the other hand, it is usually more forcible, and uncomfortable palpitation may be felt; and sometimes the force of the heart's pulsation is out of proportion to that of the artery at the wrist. The heart may be irregular in its rhythm, and dyspnoea and anxiety are frequently experienced. These symptoms, however, may be produced by other conditions, and the diagnosis is uncertain without resort to the physical signs. These are more characteristic, and in rheumatic fever, in scarlatina, in Bright's disease, and wherever there are any grounds for suspecting disease of the heart, this organ should be repeatedly examined.

The disease is commonly confined to the left side of the heart, and the mitral valves and openings are much oftener its seat than the aortic.

The earliest inflammatory change is hyperæmia and roughening of the parts involved, and the blood in passing over such roughened surfaces is agitated, and a blowing sound is likely to be produced. As this is most frequently produced at the left auriculo-ventricular opening, the sound is most distinctly heard at the left apex. In the early stage of the inflammation it is most likely to be direct; is then pre-systolic, and is a moderate blowing sound resembling the word *who* gently whispered. As the disease and roughness increase, the sound becomes louder and often harsher; and when the valves become insufficient, regurgitation occurs when the ventricles contract; the sound is still heard loudest at the apex, but is systolic—is synchronous with the first sound of the heart.

When the aortic opening is roughened or narrowed by the inflammation, or the valves are shortened and rendered insufficient, a blowing sound is heard most distinctly at the base of the heart, and may be traced up and down the sternum and along the course of the larger arteries; it is direct and systolic when there is stenosis or roughness, and diastolic and regurgitant when there is insufficiency of the semi-lunar valves. From this account it will be seen that a blowing sound is the evidence of endocarditis, and this sound should be searched for whenever endocarditis is suspected, and should be carefully watched.

Should the right side of the heart be involved, which, however, is unusual in these acute affections, the blowing sounds would be heard most distinctly at the points mentioned as the sites of tricuspid and pulmonary cardiac murmurs.

Endocardial and exocardial murmurs should be distinguished from each other, but as they are sometimes present at the same time this is not always easy, and is sometimes impossible. When, however, only one is present, the distinction may be made.

Pericardial friction sounds have already been described. They are limited to the seat of their origin—not conveyed away from the cardiac openings like the endocardial. They are more likely to be heard over the right side of the heart, are different in their character and more transient in duration.

The distinction in well-marked cases is very correctly given in the following comparison by Da Costa:

ENDOCARDITIS.	PERICARDITIS.
Blowing sounds; excited action of heart.	Friction sound; excited action of heart.
Slight if any increase of percussion dullness.	In the stage of effusion marked and extended percussion dullness.
Impulse usually strong; sounds normal, or more distinct, except at part where murmur is heard.	Impulse wavy and feeble; sounds feeble and muffled; no blowing sounds.

Prognosis.—The danger to life, and the amount of suffering, the immediate result of ordinary endocarditis, are not great. The chief immediate danger is from embolism. The vegetations and the fibrinous deposits sometimes adhering to them, when detached, float away until reaching an artery too small to allow of farther progress, when, the artery being closed by the mass, circulation is cut off from the part supplied by it, hemorrhagic infarction is likely to occur, and arrest of function may take place; and when this occurs in the brain, the most serious consequences may speedily follow.

The most frequent situation in which an embolus is arrested is the spleen, next the kidney, and next the brain.

In embolism of the spleen there is pain in the region, tenderness, and swelling, the symptoms often coming on suddenly, with more or less increase of constitutional disturbance.

When the plug is lodged in the kidney, there is pain in that region with albuminuria; and when in the brain, there is generally great shock, often hemiplegia, and not unfrequently aphasia. In all of the

cases there are apt to be rigors, and when these occur in endocarditis, they are ominous of embolic obstruction.

The femoral artery, the arteries of the liver, the coronary arteries, and those of almost any organ of the body, may be the seat of such embolic obstructions.

The remote consequences of endocarditis are often very grave. Insufficiency of the valves, or stenosis of the openings of the heart, leads to obstruction of the circulation, and to increased labor on the part of the heart. A variety of consequences follow, which will hereafter be traced.

Ulcerative endocarditis, a much rarer form of the disease, but occasionally occurring in cases of blood poisoning, is far more serious in its immediate consequences.

Hyperæmia, infiltration, destruction of the epithelium of the membrane, exudations, granulations, and the ulcerative process follow each other. From the exposed connective tissue of the membrane arise white, gelatinous, mucoid patches, appearing on the valves as whitish granulations, having a reddish-gray tint. These undergo degenerative changes and are washed away, forming superficial ulcers. They are not unfrequently sufficient, however, to penetrate the valves. Other particular ulcerative processes occur, and when at the base of the valves, portions may be cut loose and float to and fro in the current of the blood. Portions of the valves have been completely severed and have floated away in masses of considerable size. These ulcerations are not confined to the valves. Other parts of the endocardium may be the seat of the change, and the muscular tissue of the heart may be involved.

Besides pyæmia, this acute ulcerative disease is often accompanied by other acute affections, such as myocarditis, pericarditis, pneumonia or pleurisy, rheumatism, and puerperal fever.

This ulcerative form of endocarditis has but recently been recognized, and its special pathological causation may not be entirely settled. The microscope, it is said, reveals in the deposits and in the endocardium "colonies of sphero-bacteria or micrococci." These organisms are believed to pre-exist in the blood and to find their way into the vessels, the tissues, and upon the surfaces of the parts; and some contend, while others deny, that they play an important part in the production of the destructive process.

Multiple abscesses frequently accompany this disease, and bacteria are supposed to have a rôle in many of these septicæmic and metastatic affections. The influence of these organisms in the production of disease, though rendered probable by numerous facts and observations, is not yet demonstrably determined, as to its extent.

Ocurring, as ulcerative endocarditis commonly does, in connection with other severe affections, the symptoms proper to it are commingled with those of the associated diseases, and are liable to pass without recognition. Subjective symptoms referred to the heart are obscure or absent, and the physical signs—the endocardial murmurs—may not be distinguishable from those produced by simple endocarditis.

The prominent symptoms are constitutional, and are not materially different from those which occur in other cases of septic or pyæmic fever.

Following the initial chill there is high fever, with remissions, and the chills are repeated at irregular and sometimes at more regular periods.

Vomiting, diarrhœa, jaundice, purpuric spots, sweating, prostration, delirium, and coma are among the symptoms which are observed, some cases resembling more typhoid fever, and others septicæmia. Symptoms of embolism may be added in any of the cases.

Death commonly takes place speedily, preceded by coma, and cases have been reported where the ulcerative process led to rupture of the heart, and, of course, sudden death.

The diagnosis is more or less uncertain, but when regurgitant heart lesions are discovered, and are known not to have existed before the attack, and when the other symptoms enumerated are present, ulcerative endocarditis may be presumed to exist.

It is not known that recovery from this disease has ever taken place, but in the uncertainty of diagnosis it is impossible to declare that it never has.

The *treatment* of this form of the disease must be symptomatic, and will not materially differ from that advised in pyæmic fever.

TREATMENT OF SIMPLE ENDOCARDITIS.

When endocarditis occurs in connection with other diseases, especially with rheumatism, and constitutes a part of the phenomena of its associated affections, its treatment, as in pericarditis, will be governed by the disease of which it is a constituent. This will the more readily be appreciated when it is remembered that the endocardial inflammation is generally confined to the left side of the heart, is limited for the most part to the region of the valves, that it seldom in its active early stage materially interferes with the function of the organ, and does not of itself occasion much constitutional disturbance. When rheumatic, the antirheumatic remedies already advised must be pushed with vigor, and precordial pain and disturbed heart action,

when present, suggest anodynes internally (opium, etc.), and external soothing applications.

Counter-irritation, however, will sometimes be found useful in relieving pain ; and sinapisms and stimulating liniments, with which anodyne articles may be combined, will often fulfill the indication, though blisters sometimes appear to produce a decided effect, and cupping is not unfrequently resorted to.

Doubt has been expressed as to the efficacy of salicylic acid in cardiac rheumatism, while its power over the articular conditions and the rheumatic fever was admitted. I see no reason for such doubt. Rheumatic inflammation of the fibrous structure of the heart cannot differ so much from that of the joints, as not to be similarly influenced by the same agents.

The salicylic acid may have little immediate influence over the endocardial sounds, but these will often continue long after the inflammatory process ceases. The roughness, the result of the inflammation which causes the murmur, may not be removed by a remedy though it arrests the inflammation. I cannot too strongly advise that the system be brought thoroughly under the influence of the salicine or salicylate of soda, or the salicylic acid, while at the same time alkalies are freely given, and often morphine also.

There are special indications for alkalies, since it is supposed that the lactic acid in the blood is a cause of the endocardial disease. If the salts of ammonia diminish the fibrinous and plastic products of inflammation, there would seem to be an indication for their use.

The importance of *rest* to an acutely inflamed part can scarcely be exaggerated. The consequences of keeping an acutely affected rheumatic joint in constant motion would doubtless be serious, and the constant motion of the heart when inflamed must be an element of importance.

Although it cannot be entirely at rest, it should be kept as quiet as possible. This is to be accomplished by general rest of the body in bed, by the careful avoidance of stimulating and irritating foods, drinks, and medicines, and by the proper administration of cardiac sedatives when the heart is excited.

The danger of the production of adventitious material in the delicate valves, of adhesions, contractions, etc., subsequently, with permanent impairment of their function, is so great that no possible measure tending to prevent such results should be neglected.

The most effectual measures are those which will arrest or abate the inflammation in its earliest stage.

The importance of an early diagnosis and of prompt treatment

cannot be exaggerated. In cases of recurrent acute rheumatism, where the heart had suffered from each previous attack, I have witnessed the complete arrest of all the symptoms, and the avoidance of aggravation of the heart disease, from the use of salicylic acid and salicylate of soda. These effects have been too strikingly manifested in contrast with the results of all previous attacks, not to have given confidence in the preventive and curative agency of these articles, when promptly and thoroughly administered in such cases. When the inflammatory process has so far advanced that decided structural changes have occurred, they will not be immediately removed, though the inflammation be arrested. The removal of inflammatory products in their early stages may, however, be promoted, and their organization be checked or prevented by various agents; and such as experience has proved to have an effect in similar conditions in other parts are indicated where the heart is the seat of the disease.

Among these, at least in the estimation of many, the alkalies and various salines, including the iodide of potassium and the mercurials, have long held a place. The propriety of bringing the system under a mercurial impression in cases of endocarditis is doubted, and may properly be questioned; and in feeble and delicate cases the mischief which may be done will often far counterbalance any good that may be hoped for. Indeed, the influence of mercury over rheumatic inflammation and its results, wherever situated, is certainly not striking, and must be admitted to be doubtful, and, on the whole, its free use in rheumatic endocarditis is not indicated. In the present state of professional opinion it cannot be justified. It is, however, different with the alkalies and iodide of potassium. They seem to me indicated—the alkalies earlier, and the iodide somewhat later in the disease. My advice is, therefore, that in acute rheumatism affecting the endocardium as well as the joints, after a cathartic of Rochelle salts, preceded by a mercurial for its impression upon the secretions, the system should be brought under the specific influence of the salicylates, as advised under the head of rheumatism; that this impression should be accompanied and followed by alkalies freely, and that if heart murmurs continue after a week or so, the iodide of potassium should be given in as free doses as may be borne. At any time, should there be much pain or irritability, opiates and other anodyne and sedative measures should be resorted to, and *absolute quiet and rest enjoined*. The bowels, of course, should be kept open, and the diet should be regulated according to the general condition, milk and farinaceous substances being selected rather than broths and meats. The question of local depletion by leeches or cupping may be raised in the earlier stages, and in vigorous patients the abstraction of blood may be of

decided use. In a later stage, where the inflammation lingers, blisters may be applied with propriety and the hope of benefit.

There should be rest, not only during the acute stage of the disease, but for a considerable time afterward; and mental excitement, a stimulating diet, spices, strong coffee and tea, and alcoholics should be carefully avoided.

Should, at any time, the heart's power fail and death be threatened by asthenia, digitalis should be given, and various unirritating tonics may be useful.

When we shall have discussed the more remote consequences of lesions of the valves, the openings, and the muscles of the heart, it will be seen that some are comparatively slight, may be compensated for and remain stationary; some may even recede and disappear, while others are more grave and are progressive, and serious ultimate consequences are to be apprehended whenever the lesion is considerable. It will thus be seen that the greatest care should be taken to avoid these lesions.

MYOCARDITIS.—INTERSTITIAL MYOCARDITIS.—CARDITIS.

Inflammation of the muscular structure of the heart, which is indicated by the above terms, may be either acute or chronic. The acute form is best known, though it is thought, especially by the German pathologists, that chronic myocarditis is a common cause of the degenerations of the heart's structure not unfrequently met with.

Ordinary myocarditis is defined by Gowers as "An acute affection of the walls of the heart, consisting in interstitial serous exudation or cell infiltration, and degeneration of the muscular fibres." Change in the muscular fibres may occur without involving the interstitial tissue; but when thus confined to the fibres, and when it is general throughout the heart, it is thought to be the result of some general state of the blood, and does not present the full phenomena of inflammation.

Muscular inflammation of the heart may be general, affecting all parts of the organ, or it may be limited to a small area. In the more acute cases the tendency is to suppuration and the formation of abscesses, single or multiple. This is particularly the case when the disease is secondary, as it so often is, to pyæmic affections; and then large numbers of bacteria are found in the abscesses, especially in their early stages.

In ulcerative endocarditis, and in various acute infectious diseases, this suppurative carditis is occasionally found.

Acute carditis in any form is very rare as a primary disease, but

eases have been seen which were attributed to exposure to cold after severe exertion, or to blows on the precordial region. It may occur from extension of inflammation from the pericardium, as well as from the endocardium; and, in some exceedingly rare cases, rheumatic inflammation is said to have attacked the muscle of the heart without affecting its coverings.

A cardiac abscess may discharge from the outer surface of the heart into the pericardial sac or into the cavity of the heart. In the latter case the pus will flow off into the blood, and blood will be likely to take its place, filling the cavity of the abscess. This may lead to the formation of a cardiac aneurism. Indeed, a rupture of the heart may be a consequence. An abscess in the septum of the ventricles may establish a communication between them. An abscess of moderate size may here, as elsewhere, become incapsulated, and the pus may undergo changes and finally be absorbed—the abscess cicatrizing.

The more chronic forms of inflammation of the heart-muscle are apt to result in fibroid and other changes without the suppurative process.

Bands and nodules replace more or less the muscular fibres, which impair the power, and, by contraction, restrain the movements of the heart. In other cases softening and degeneration may result, the part may yield to the pressure of blood within its cavity, and produce aneurismal bulging or a rupture similar to what occurs in abscesses bursting through the endocardium.

The aneurisms from chronic non-suppurating myocarditis are more frequently near the apex of the left ventricle, but may appear near the base. They sometimes contain thrombi, having resulted from embolism of the coronary arteries; and small fibrous bands are sometimes found running through the muscles, which have probably an inflammatory origin.

In syphilitic subjects gummata may be found in the heart, surrounded by inflammatory and indurative growths, involving the pericardium or the endocardium.

The left side of the heart in myocarditis, as in endo- and pericarditis, probably from its greater labor in carrying on the post-fœtal circulation, is, after birth, the most frequent seat of the disease.

The *clinical history* of myocarditis is not well marked. There is an absence of characteristic objective phenomena, as well as of subjective symptoms. The heart's actions are impaired and variously disturbed, but not in a manner to be distinguished from other diseases of the organ. Pain may or may not be present, and is not diagnostic; and probably the best evidence of the acute form of the disease, when extensive, is extreme rapidity and great weakness of the pulse.

The diagnosis is obscure, and the progress and termination are variable, dependent upon the character of the diseases with which it is associated, and upon the character and extent of the inflammation.

The *treatment* must be symptomatic. The diseases with which it is associated must receive attention; and the distressing phenomena connected with the deficient or perverted heart action must be palliated. The diet should be looked to, and should often be sustaining; and of medicines, digitalis and strychnine are most likely to be required.

In the suspected aneurismal conditions, iodide of potassium, which experience has proved to be so remarkably beneficial in aortic and other aneurismal distentions, may be worthy of a trial.*

PERMANENT LESIONS OF THE VALVES AND ORIFICES OF THE HEART.

—VALVULAR LESIONS AND THEIR ANATOMICAL AND PHENOMENAL CONSEQUENCES.

The term Valvular Disease is commonly used to indicate not only structural changes in the valves, but also in the openings which they normally close.

Lesions of the valves generally render them incapable of closing the orifices, so that the blood *regurgitates* when the cavity into which it passes through the opening contracts upon it. Lesions of the openings commonly cause narrowing, so that the blood is *obstructed* in its passage through its normal course.

There are thus two kinds of lesions, *regurgitant* and *obstructive*. The inability of the valves to close the orifice is called insufficiency, while the narrowing of the orifice is called *stenosis*. Some of the causes, particularly the inflammations producing these lesions, have been discussed, and the murmurs resulting from them have also been mentioned.

We are now to consider also some other causes which may produce the lesions, the results which follow from them, the means of distinguishing them, and the remedies which may be applied. By far the greater number of these lesions are produced by inflammation, often commencing as acute, but terminating in chronic endocarditis; and sometimes the endocardium is chronically inflamed from the beginning. As already stated, the left side of the heart is much more frequently inflamed than the right, and in rheumatic cases the mitral valves are more frequently attacked than the aortic. But atheroma-

* See Balfour's Clinical Lectures on the Heart and Aorta, and article on Aortic Aneurism.

tous degeneration may cause lesions, and this usually affects the aortic valves and orifice.

Cancerous and syphilitic diseases, calcareous deposits, and other morbid growths and degenerative changes may cause these lesions.

Fibrous productions, calcareous deposits within them, adhesions and contractions, and fatty degeneration of the adventitious tissue originate in inflammation. Other changes may not have an inflammatory origin, but are the result of other slow nutritive changes. Some cases are comparatively rapid, and others are very slow and insidious in their development and course. The common results are, thickening and rigidity of the valves, adhesions to each other or the walls of the heart or vessels, contractions and shortening, rupture or destructive changes, morbid growths preventing the proper play of the valves, rigidity and narrowing of the openings, destructive changes and enlargement of the openings, and contracting rigidity; and sometimes elongation and rupture of the chordæ tendineæ may co-exist. Deposits of fibrine from the blood, constituting thrombi, may take place on the roughened surfaces, and they with fragments of valves or calcareous matter, or of vegetative excrescences, may be detached and carried into the vessels and tissues, producing the phenomena of embolism. The openings are sometimes reduced to exceedingly small dimensions while life is still continued; the mitral becoming so small as scarcely to admit of the end of the little finger, while the aortic may be no larger than a crow-quill.

The practical importance of these lesions consists in the fact that they interfere with the function of the heart in circulating the blood, and produce various morbid phenomena throughout the body.

Clinically considered, and in reference to the signs produced, we have, (1) regurgitation, (2) stenosis, (3) regurgitation and stenosis combined, (4) mere roughening so as to produce murmurs without either the obstruction from stenosis or regurgitation. These latter, though giving rise to blowing sounds which may cause alarm, yet are unaccompanied by other symptoms, and are of little or no consequence.

The most frequent of these forms of lesion is where regurgitation and stenosis are combined; one or the other, however, usually predominating. The next most frequent is regurgitation without stenosis—stenosis without regurgitation being more rare. When the cavities of the heart are much dilated without other special lesions, the openings may be so large as not to admit of closure by the normal valves. There is then said to be relative insufficiency of the valves. This is most frequent at the right auriculo-ventricular opening—with the tricuspid valves.

The lesions which produce material obstruction or regurgitation are followed by changes first in the heart itself, and secondly in various other organs and functions of the body. The first effect upon the part of the heart concerned is distention with blood.

This in a weakened condition of the tissues may lead to simple dilatation of the cavity and thinning of the walls. Usually, however, as these processes go on slowly, the distention with blood excites the muscle to increased contraction, and this increased labor results in increased nutrition and growth, in hypertrophy or hypersarcosis of the muscles so excited. This increase of muscular tissue and power is compensatory, enabling the heart to overcome the obstruction and continue the circulation. This compensation may be so complete that no morbid symptoms are noticeable, at least for a considerable time, and when no extraordinary call is made upon the heart by active exertion, by mental emotion, or by feverish excitement, when the lesion is stationary, this state of things may continue indefinitely. When, however, as is often the case, the lesion is progressive, or when the dilatation of the heart renders the relative insufficiency greater, symptoms appear and persistently increase. The heart in its struggle to carry on the circulation becomes more and more enlarged, partly from hypertrophy, and partly from dilatation. At length, from over-distention, overaction, and fatigue, its power diminishes, hypertrophy yields to dilatation, the obstruction increases, and the power to overcome it diminishes. Venous congestions, dropsical effusions, dyspnoea, deranged functions of various kinds, and finally arrested circulation and death end the more or less protracted struggle.

Lesions at the different valves and openings produce peculiarities in phenomena which, for a proper understanding of the subject, it is essential to trace.

Insufficiency of the mitral valves, which is the most frequent of all these lesions, connected often with stenosis of this opening, presents conditions which, from what has preceded, will be readily understood. On the contraction of the ventricle a part of the blood will flow back into the left auricle, instead of all passing on, as it should, through the aortic opening to supply the general system. The regurgitation distends the auricle, obstructs the flow into it of blood from the lungs, which causes congestion of those organs; and this in turn obstructs the free flow of blood into the lungs from the right side of the heart; and the detained blood distends and excites that part of the organ. This in turn congests the brain, the liver, and, more or less, the whole body with venous blood. As the blood by the contraction of the left ventricle is in part thrown into the left auricle, it returns again into the ventricle, distending and exciting it to

increased efforts, and this produces hypertrophy of its walls, and ultimately dilatation of its cavity.

Mitral insufficiency, then, is distinguished by the general symptoms of venous congestion and its consequences, first manifested in the lungs and afterward in the rest of the body.

This occurs as soon, at least, as compensation is not sufficient to counterbalance the obstruction; but before these symptoms are manifested, there may commonly be heard murmurs as the regurgitating blood passes through the narrowed aperture of the insufficient valves, or as it meets with a current flowing in the opposite direction. This murmur, as already explained, is heard most distinctly at the left apex, and is synchronous with the contraction of the ventricle, and consequently with the impulse of the heart and its first sound. When this sound is loud, it is heard at a considerable distance from the heart, and on the back side of the chest, near the corner of the scapula. The enlargement of the heart will be detected by percussion, by the position of the apex beat, and in young subjects by a moderate degree of bulging in the region; and hypertrophy will be distinguished from dilatation by the greater force and more heaving character of the beat, and by the loudness and more prolonged and more booming character of the sounds.

In mitral stenosis less blood flows through the left auriculo-ventricular opening when the auricle contracts, the blood distends its cavity and causes its hypertrophy, is forced back upon the lungs, and obstructed in its flow from them. These organs, the right side of the heart, and the whole venous system become congested as in the case of regurgitation; but the left ventricle receives less than its proper quantity of blood, is not therefore excited, hypertrophied, or dilated. The contraction of this ventricle is therefore not increased, the heaving pulsation against the walls of the chest is not as great, and the apex beat is not as far to the left.

Mitral stenosis will be marked by the same conditions of venous congestion as regurgitation, but will be distinguished from it by the difference in the condition of the left ventricle, and especially by the murmur, which when it is heard is presystolic rather than systolic, as it is produced by the direct flow of the blood through the narrowed and roughened opening, and that flow takes place when the ventricle is dilating, and is most rapid a short time before its contraction.

Mitral stenosis without insufficiency and regurgitation seldom takes place. The occurrence of both together will be accompanied by mingled phenomena—by enlargement of the whole heart, by venous congestion of the whole system, and often by a double murmur, presystolic and systolic.

In insufficiency of the aortic valves, during the diastole of the ventricle and the elastic contraction of the aorta, the blood just thrown out of the heart returns into it, distending and exciting it to increased action, leading to compensatory hypertrophy, and, as in the other cases, ultimately to dilatation. This leads to some degree of congestion of the lungs, to distention of the right heart, and to venous congestion of the rest of the system; but these results do not follow as readily nor as extensively as in mitral lesions. The powerful action of the hypertrophied ventricle throws the blood with much force into the aorta and its branches, causing a forcible pulse; but the speedy return of a portion of the blood into the ventricle causes the pulse to quickly recede, giving it a projecting and retiring, or a jerking character. The murmur will be diastolic and regurgitant, will usually be heard loudest at the right margin of the sternum between the second and third ribs, but radiated down and up the sternum, and along the large arteries, and will be heard at the time of the second sound of the heart, and a little time after, or it more frequently takes its place. The distention of the ventricle may cause relative insufficiency of the mitral valves, or they may be diseased at the same time, aggravating all the symptoms. When the disease is simply aortic regurgitation, the suffering of the patient is not as great as from similar disease at the mitral orifice. More exercise can be taken, less anxiety is felt; but the heart is more liable to sudden suspension of its function, and consequently sudden death is more likely to occur.

In *aortic stenosis* the narrowing of the aortic orifice prevents the left ventricle from readily emptying itself. It is therefore distended, is excited to greater efforts, and becomes hypertrophied, but not generally to the same extent as in insufficiency of the valves.

When stenosis and insufficiency are combined, the obstruction and enlargement are great. In these cases, when the lungs become congested and the right heart begins seriously to suffer, the termination is more speedy than in cases of mitral disease.

Aortic stenosis is marked by hypertrophy of the left ventricle, by forcible and heaving palpitation, by a small and comparatively feeble pulse, and sometimes by a tendency to syncope from failure of systemic blood supply. Its murmur is direct, is synchronous with the ventricular contraction and the first sound of the heart, and is heard at the same point and with a similar radiation as the murmur of aortic regurgitation.

It is distinguished from the latter chiefly by the time at which it is heard, and by its not taking the place of the second normal heart sound.

The right side of the heart, as has repeatedly been stated, is much

less frequently the seat of endocardial inflammation after birth than the left ; and as endocarditis is the most frequent cause of valvular lesions, the latter are more rare upon the right side of the heart than upon the left. Congenital lesions, however, are more frequently upon the right side.

Insufficiency of the tricuspid valves is more likely to be relative from dilatation of the ventricle than from shortening of the valves from endocarditis. From whichever cause, it is usually secondary to disease of the left side. The murmur of the right side dilatation and hypertrophy, as the result of mitral disease, has been fully intimated if not sufficiently explained, and will be readily understood by calling to mind the mechanism of the cardiac and pulmonary circulation. In primary tricuspid regurgitation unaccompanied with other lesions, the left ventricle is not enlarged, since the pressure in the pulmonary veins is not increased, and the blood is not unduly forced into the left heart ; but systemic venous congestion exists as in the other cases of obstructive heart lesions.

Stenosis of the tricuspid opening without insufficiency of the valves has been observed as a congenital condition, but not as acquired in post-fœtal life. It is sometimes found accompanied by other valvular lesions, and is only, and but imperfectly, compensated for by dilatation and hypertrophy of the right auricle. Its rarity makes it a curiosity in medical observation, and but little about it is practically known.

Lesions of the pulmonary valves, though less frequent than the aortic, are still occasionally met with. They are perhaps oftener of fœtal origin, and may be associated with other morbid states. They may be completely compensated by dilatation and hypertrophy of the right side of the heart, and are seldom alone the subject of a physician's care. The left side of the heart is not enlarged by obstruction here, but has, on the contrary, been found atrophied. Systemic venous congestion, however, would result from either stenosis or insufficiency at this point.

In pulmonary stenosis a murmur would be heard most distinctly at the seat of this opening on the left side of the sternum, and synchronous with the first sound of the heart. In pulmonary insufficiency a murmur would be heard at the same point, but synchronous with or covering the second sound. It would be distinguished from aortic lesions by its being most loudly heard at the left of the sternum, by the absence of hypertrophy of the left ventricle, and congestion of the lungs, and by the difference in the general symptoms.

It will have been observed by the careful reader that lesions of the left side of the heart, when grave, sooner or later cause congestion of

the lungs, and that all obstructive lesions cause congestion of the general venous system.

The consequences of such congestion upon the liver, stomach, spleen, intestines, and lungs have already been noticed. The effects upon the kidneys and brain are to be considered in connection with other diseases of those organs, and need not be particularly dwelt upon here.

The compensatory arrangements have been explained, and the fact stated that in progressive lesions the balance of compensation is sooner or later destroyed. It should be mentioned that the destruction of this balance is often hastened by fatty and other degenerations of the heart, and, as a general thing, by whatever vitiates, deranges, or weakens the general system.

Excessive exertion, feverish excitement, obstructive disease of the lungs, failure of the nutritive functions, etc.; will contribute to this result. When the heart is organically affected, all diseases which produce death chiefly by asthenia are rendered much more dangerous. This was referred to in the description of typhoid fever and of various other diseases.

Cyanosis and anasarca are particular results of organic heart affections.

An important fact in relation to this subject, and one which should be emphasized, is that *murmurs do not always accompany valvular lesions*. At this present writing two well-marked cases of cardiac lesions, with hypertrophy and dilatation of the heart, though not extreme, but one with very marked cyanosis, and both with extensive œdema, where other causes of their existence are excluded, are under observation and treatment, and in neither case can murmurs be detected. There is, doubtless, a *premurmuric* stage, and certainly a *post-murmuric* stage, where a murmuric stage follows or precedes; and there are, doubtless, cases which run their whole course without perceptible murmurs. In such cases the diagnosis is less certain and specific, but without the murmurs it may often be made. A post-murmuric stage is not unfrequent. When dilatation becomes great the heart is often so weakened that the blood is not impelled with sufficient force to produce the murmurs which at a previous stage were very distinct and even loud. Cases of that kind have repeatedly come under my observation, and have greatly puzzled the attending physician, who had reported murmurs which at the time of a late consultation could not be heard. Some other signs besides the general symptoms may aid in the diagnosis in the premurmuric stage. Walshe, Da Costa, and others speak of a dull or clanging tone in the

aortic valves, when thickened, before a murmur can be detected. In rheumatism there may be inflammation of the heart earlier than it can be detected, and it has been suggested that this morbid condition may be primary in the disease—may precede the joint affection, and have an influence in its production. But this view needs confirmation.

Hypertrophies and dilatations may occur which point to obstructive lesions where murmurs are absent. Fothergill says, "I firmly believe that a murmur is not essential to the diagnosis in every case," and sometimes, if not a positive, a proximate diagnosis may be made without stethoscopic signs. In all ordinary cases, however, these signs are essential even to a proximate diagnosis of the particular lesions, and no one should consider himself competent to deal properly with diseases of the heart who has not carefully studied the art of physical diagnosis. For this reason I have endeavored in this general work to give the elements of the art, and in as brief but as clear a manner as possible to point out their application to the different forms of heart disease with which we ordinarily meet.

Some further account of the *Clinical History of Valvular Lesions* seems required. Some of these lesions are so slight, or so completely compensated, as to produce no noticeable obstruction to the circulation and no symptoms, and are only to be detected, if at all, by their physical signs. After an endocardial inflammation, an excrescence or some roughness may be left, which will agitate the current of blood and produce a murmur without producing stenosis of the openings or insufficiency of the valves. There will be no enlargement or dilatation of the heart, no excess or irregularity in its action, and in such cases no evil consequences are likely to follow. Such cases are only curious and require no treatment. These murmurs are, however, evidences that disease has existed, and that perhaps it is more likely to occur again. Another attack of endocarditis might produce lesions more serious in character, and care should be taken to avoid special causes. A subsequent rheumatic attack should be treated with great promptness, and the heart in such attacks should be carefully watched.

When lesions induce obstruction or regurgitation of the blood sufficient to cause hypertrophy or dilatation, symptoms are usually produced, but commonly not before. In proportion as the dilatation predominates over the hypertrophy are the general symptoms and the danger increased.

In mitral obstruction or regurgitation, the first effects on other organs than the heart, as already pointed out, are upon the lungs, and the first symptoms are usually there manifested. Dyspnoea on exertion is commonly the first noticeable symptom. When the patient is at rest and free from excitement no uncomfortable sensations are

felt; but when the circulation is hurried, there is not only shortness of breath, but an uncomfortable sense of fullness in the chest, and it may be located particularly in the region of the heart. Some pain may be experienced, though it is very often absent, and palpitation or a sense of the beating of the heart may be unpleasantly observed. At length dyspnœa becomes habitual, especially when dilatation of either side of the heart has taken place, and it is greatly exaggerated on even moderate exertion. As the disease advances the patient often becomes unable to lie down, and this orthopnœa is usually due in part to other changes than the mere congestion in the lungs. Pulmonary œdema is likely to take place; a slow inflammatory process, either of the lung tissue or the bronchi, is established; a cough, sometimes dry, but often accompanied with a watery, mucous, and occasionally a bloody expectoration, is present; sometimes a moderate hæmoptysis or bronchorrhagia repeatedly occurs, and in more rare cases hemorrhagic infarction and pulmonary emboli complicate the cases. Pigment indurations of the lungs, and other changes referred to when diseases of those organs were described, are apt to take place.

In an enlarged heart, while hypertrophy predominates, the action is abnormally strong, as will be readily detected by the forcible impulse and the heaving sensation communicated to the hand placed over the region. The patient may become accustomed to the increased beat so as not to complain of palpitation. The pulsation in the arteries is always weak in proportion to the heart's beat, and is absolutely so as dilatation advances. Sometimes the radial pulse is intermitting, the wave produced by the systole of the heart not reaching the artery; or the fatigued and enfeebled heart may omit a contraction. In mitral stenosis such intermittency and other irregularities of action may arise from a deficiency of the blood which finds its way into the left ventricle.

“The characters pertaining to the form of the pulse, as ascertained by the sphygmograph, in cases of mitral regurgitation, are notable variations in the length of the line of ascent in different pulsations, shortness of this line in a greater or less number of pulsations, its vertical direction and marked dicrotism in the line of descent. In cases of mitral obstruction the line of ascent is longer, and the variations in different pulsations are less, the direction of this line being also vertical, and the line of descent showing dicrotism. These characters denote quickness of the ventricular systole, feeble arterial tension, and want of uniformity as regards the quantity of blood sent into the aorta in different beats.”*

* Flint's Practice of Med., p. 338.

Dyspnœa and the inability to lie down often seriously interfere with sleep, and though no considerable pain may be experienced, the sense of distress is often great and more difficult to bear than positive pain.

As a rule, toward the last, and often at a comparatively early stage, at least a long time before death if proper treatment is instituted, dropsical effusions occur, especially in the areolar tissue, and anasarca, particularly of the lower limbs, the scrotum, or the labia, takes place. This is often extreme, and various serous sacs may be filled with fluid. The skin of the lower extremities is apt to become inflamed, and if it is wounded to any extent, ulcers are apt to follow. These would drain away the fluid, but they are difficult to heal and may produce much suffering. According to Prof. Sée, of Paris (on Diseases of the Heart), a dropsical variety of heart disease occurs where there are no stethoscopic signs, the sole objective phenomena being œdema of the inferior extremities, though at times the anasarca becomes more general, but without albuminuria. In cases of this kind which have come under my observation, albumen has appeared in the urine, but not in very great quantities, and renal casts were absent. The face and lips are often blue, less pale and anæmic than in most cases of renal dropsy. When the dilatation is marked on the right side of the heart the cervical veins become turgescient, and not unfrequently pulsation in them will be observed. Pulsation of the liver may also take place, the regurgitating blood being forced back through the vena cava at each contraction of the heart. The spleen, the liver, the stomach, etc., become congested, hemorrhage may take place from the stomach or bowels, and the functions of all these organs may be impaired, as we have already seen. In many cases, however, nutrition seems but little affected, and emaciation is seldom extreme.

The *kidneys* participate in the congestion, the secretion of urine is sometimes small, though at other times it is free, and albumen, but without casts, is generally found in it. These symptoms, taken in connection with the physical signs, will render the diagnosis satisfactory.

Aortic lesions, sufficient to produce direct obstruction or regurgitation, give rise to some symptoms similar to those produced by mitral lesions, which have just been described. Among the first phenomena, as the left ventricle is apt to be much hypertrophied, are palpitations, especially on exercise, or under mental excitement. The whole body, as the disease advances, may be agitated by the violence of left ventricular contraction, pain is sometimes present, and occasionally is a marked symptom; but it is sometimes absent, and the patient can

scarcely be persuaded that any serious disease exists. Indeed, in almost every form of organic lesion, less anxiety is felt and expressed than in mere functional affections destitute of danger.

Pulmonary congestions and their results do not seriously occur until the right side of the heart becomes dilated; and in not a few cases the disease suddenly ends fatally, where the lungs have not at any time been seriously disturbed.

General dropsy from aortic lesions but seldom occurs. This, as well as freedom from pulmonary lesions, arises from the fact that death frequently takes place before right-heart dilatations and extreme venous congestions supervene.

The comparative and absolute weakening of the arterial pulsations in direct obstructions, and the jerking or collapsing pulse, giving a sensation in aortic regurgitation as if a ball of blood was shot through the artery, have been sufficiently explained. In aortic insufficiency the temporal artery will generally be seen projecting and quickly receding at each pulsation; and this has often convinced me of the existence of that particular lesion, before the more conclusive exploration was made. Says Prof. Flint, whose precise, descriptive language it is a pleasure to quote: "The tracings by the sphygmograph, in cases of aortic obstructive lesions, give an oblique and curved line of ascent, denoting the slowness with which the blood is driven into the aorta, and, in the line of descent, diastolicism is either slight or wanting. In cases of aortic regurgitation the line of ascent is vertical, and the diastolicism in the line of descent is marked. If, as is not unfrequent, senile induration of the arteries coexists, the summit presents a plane of greater or less length; if this condition of the arteries does not exist, the upper part of the diagram representing a pulsation is pointed, and the line of ascent may be notched near its upper extremity."

Attacks of pain, and a sense of impending dissolution are not unfrequent in cases of aortic regurgitation. This arises from occasional distention of the ventricle, from the blood pouring in from the aorta on one side, and from the auricle on the other, to such an extent as to prevent for a time its contraction.

This arrest of contraction is sometimes complete and final—sudden death thus taking place—and may come on from disturbance of nervous action when the patient is quiet, or may be produced by exertion or mental emotions. This is more likely to be the case when dilatation preponderates over hypertrophy, but it may occur while hypertrophy is in the ascendant.

Not only irregular innervation, but defective circulation through the coronary arteries, has a striking effect upon the action of the

heart, and when disease extends to the origin of those vessels, the danger of sudden interruption of the heart's action is much increased. When there is great patulency of the aortic opening and the semi-lunar valves are largely deficient, the force of the aortic recoil is so completely expended in throwing the blood back into the heart that the coronary arteries may not be filled, and thus the action of the heart may be suspended.

Not unfrequently direct aortic obstruction and regurgitation are combined in the same case. The symptoms will then be modified and aggravated, and a double murmur will generally be heard. In the same case with these, mitral lesions may exist, and complications which will almost defy analysis will be present. This confusion will often be increased by irregular innervation and spasmodic action, when the symptoms, rather than a knowledge of the precise elements and relative amount of the complex lesions, must be the guide in treatment. Mitral insufficiency, when combined with aortal regurgitation, by allowing the blood to flow back into the auricle and lungs, may relieve excessive distention of the ventricle and prevent the sudden cessation of its action. Though in this combination there may be less danger of sudden death, the rate of progress of the steady failure will be likely to be increased.

The physical signs of the aortic, as of the mitral lesions, have been pointed out. It may be mentioned that the murmurs vary in loudness, in pitch, and in character. When the ostium is much narrowed, or the valvular lesion is such that only a small aperture is left when the valves close, the murmur may be high pitched, and even musical. In some there is whistling, in others croaking, in still others whizzing, etc.

The rarity of the tricuspid and pulmonary lesions renders a full description of the symptoms produced by them less important. Tricuspid regurgitation, the morbid condition chiefly met with at this point, causes, primarily, dilatation of the right auricle, and then congestion of the vena cava and the whole venous system. The lungs are not congested, but general dropsy is likely soon to occur, and all the consequences to the brain and abdominal organs already detailed, are likely soon to follow.

Lesions at the pulmonic orifice have a similar effect, and the phenomena resulting need not further be described.

Most of the *causes* of valvular lesions have been mentioned in the descriptions which have preceded. Rheumatic endocarditis is by far the most frequent. The serious obstructions are then more or less remote—sometimes not appearing for years after the acute attack.

When advice is sought, enlargement is generally present, and may

have existed, perhaps unnoticed, for a long time. But other causes may produce these lesions. Violent exertion may rupture valves or their tendinous supports; and slow nutritive changes, deposits and degenerations, may produce the lesions. Rheumatic endocarditis by preference affects the mitral opening; atheroma, the aortic; and congenital affections are mostly upon the right side of the heart. Lesions of this kind, and other heart affections, are more common among soldiers in active service than in civil life. Such lesions are more common among those who have laborious occupations—who make great muscular exertion; while functional derangements are more common among those of sedentary occupations.

The *Diagnosis* of all these conditions will depend upon a careful observation of the general symptoms, and the particular physical signs, remembering that the usual physical signs are sometimes absent when structural lesions exist, and that murmurs are sometimes present from causes which indicate neither obstruction nor insufficiency of valves, and that various functional derangements may simulate structural diseases.

The *Prognosis* in valvular lesions is a matter of great interest. As a rule, a valvular lesion of a character to cause obstruction or regurgitation, and which has continued a sufficient length of time to produce hypertrophy or dilatation, will not be repaired. Still, life may be prolonged indefinitely, and sometimes much improvement may take place. In some cases of young persons where marked lesions have been the result of rheumatic endocarditis, the sounds have finally been lost, dilatation and hypertrophy have diminished, and all symptoms have disappeared. Cases of this kind have come under my own observation where error as to diagnosis seemed impossible. In other cases great improvement has taken place after severe symptoms have occurred, but where evidence of lesions still continued. In other cases, with temporary relief from treatment, the disease has progressed, sometimes slowly and sometimes with more rapidity, reaching the fatal period by successive painful steps; while in other cases, as in aortic insufficiency, sudden death has occurred before much suffering was produced.

The comparative prognosis in the different lesions will be inferred from the descriptions given.

The occurrence of severe dropsical symptoms is generally regarded as evidence of approaching dissolution, but not unfrequently, under proper treatment, great improvement takes place, activity may be restored, and life preserved for long periods.

The general prognosis of valvular lesions, however, is unfavorable, and in a majority of cases the fatal result is only a question of time.

Intercurrent affections often terminate a case, and the immediate cause of death, where no other independent disease has intervened, varies in different cases. Some die of a dependent pulmonary œdema or pneumorrhagia, especially in mitral lesions. Cerebral hemorrhage may terminate a case where there is dilatation of the right side of the heart and hypertrophy of the left ventricle; while in other cases emboli from the cavities may be lodged in the brain, the lungs, or other organs, producing fatal results. In other cases the heart, dilated and perhaps degenerated, becomes exhausted and ceases to carry on the circulation. In some the struggle is protracted and the suffering is great, not so much from pain as from anxiety and distress. Occasionally severe pains occur, often in paroxysms, sometimes in the region of the heart, and at others in more distant organs. Dyspnœa, in most cases, is a prominent and distressing symptom, aggravated by œdema and the slow inflammatory changes of the lungs which have already been described, these conditions being the immediate cause of death.

TREATMENT OF VALVULAR LESIONS AND THEIR CONSEQUENCES.

In the treatment of these conditions several indications present themselves.

The *first* is to check the progress, or remove, if possible, the structural lesions and the morbid effects upon the heart which follow, especially the dilatation.

The *second* indication is to relieve those symptoms which result from the obstructed circulation.

The *third* is to improve the general condition of the system—the nutrition, secretions, innervation, and particularly the state of the blood.

As already stated, the lesions, when fully established, can seldom be repaired. The contractions of the adventitious tissues, the result of inflammation, are generally permanent. Calcareous deposits cannot be removed, and destroyed tissues are not restored. Hypertrophy to a certain extent compensates, but dilatation increases the patulency and relative insufficiency of valves.

Excitement of the heart and increased strain upon it tend to hasten the resultant changes, and quiet and comparative rest will retard them. The morbid influences which impair nutrition tend to produce degenerations, and improving nutrition may prevent them. Dilatation may be checked by means which will give increased tone to the heart, and sometimes its more firm and constant contraction may be effected. Thus, though the morbid structural states of the valves may not be improved, their immediate results on the heart may, to

some extent, and in some cases at least, be remedied. For keeping the heart as much as possible at rest, and relieving it from overexcitement and strain, abstinence from active muscular exertion and from intense mental excitement must be enjoined. Sexual excesses must particularly be warned against, and a moderate, temperate life in all respects must be insisted upon. Coffee, tea, and alcoholics should, as a rule, be abstained from, and sources of reflex, or other forms of irritation, physical or mental, should, as far as possible, be removed.

The fulfilling of these indications may require a variety of means, hygienic and medicinal. A knowledge of the conditions to be remedied, and a clear conception of the particular objects to be accomplished, will suggest the means for effecting them. When the general functions of the body are properly performed, and the hypertrophy is compensating the obstruction, no interference other than the observance of hygienic measures will be required. If the heart is unduly excited, besides removing sources of irritation, whatever they may be, cardiac sedatives and anodynes, morphine hypodermically, and possibly such sedatives as aconite and veratrum viride may temporarily be required. By some the nitrite of amyl is highly recommended, especially if the cardiac excitement is accompanied by pain. It relaxes the capillaries, diminishes arterial tension, and may thus favor the unloading of the left ventricle, while diminishing the irritation of the heart itself, and in free doses diminishing its force. Its value and safety in these cases is not fully established by extended and varied experience, and it should be used with caution. In angina pectoris, even where more or less structural disease is present, its beneficial effects are well attested, and it is worthy of a careful trial in sudden attacks of cardiac excitement with left ventricular hypertrophy.

Irregular innervation is frequently combined with organic valvular disease, producing paroxysms of distressing symptoms, which may be relieved by a variety of nervines. It is often impossible to know without trial what will produce most relief or be best borne, and trials may be made with various agents. The nitrite of amyl is to be given by inhalation. Its effects are speedy and should be watched. With some only a fraction of a drop can be borne, but generally two, three, or four drops can be inhaled, and more in some cases will be required to produce its full physiological and therapeutical effects. It may be diluted with alcohol when the smaller doses are given. These sedative measures, by quieting excessive action, tend to give the heart rest and thereby delay the morbid changes. But the condition of the heart requiring most interference is that of dilatation. When the hypertrophic compensation becomes insufficient, dilatation occurs, and the effects of obstructed circulation are produced.

The most efficient article for increasing the tonicity of the heart, checking the dilating process, diminishing the frequency of pulsation, and giving longer periods of rest to the wearied organ, regulating its action and aiding it in overcoming the obstruction to the circulation, is *digitalis*. Perhaps the most striking effect of this article is in fulfilling the second indication—relieving the symptoms which result from obstructed circulation. But it tends to prevent dilatation as well as its consequences, and under its use, especially when combined with other agents, a dilated state of the heart is sometimes notably diminished. The combination most efficient in my experience, especially in cases of mitral regurgitation, is that of the elixir of the phosphate of iron, quinine, and strychnine, with the *digitalis*. A drachm of the elixir, together with from six to fifteen drops of a good tincture of *digitalis*, three times a day, has produced the most gratifying effects in numerous instances, and in some cases quite astonishing results. Moderate but long-continued doses of the *digitalis*, with equally long-continued use of the elixir are required. I direct the tincture of *digitalis* and the elixir to be put up separately, the tincture to be commenced in six or eight drop doses, and gradually increased until some slight physiological effect of the remedy is experienced, such as a sense of stricture over the brows, headache, dizziness, disturbed vision, or material slowing of the heart, when it is to be discontinued for a time, and afterward smaller doses are to be given. A quantity, however, sufficient to produce any of these unpleasant effects must not be long given, the dose being kept below the point which produces these more prominent physiological actions.

These remedies may be occasionally suspended for moderate periods, but generally they should be continued for months, and they may often be used a large portion of the time for years. *Digitalis* continued for a long time in large doses may affect unfavorably the motor power of the heart, causing it to become rapid, weak, and irregular. It should, therefore, be carefully given, its action observed, and this effect avoided. In the smaller doses recommended I have not observed such results, and very seldom any unpleasant effects rendering its abandonment necessary. Sometimes, however, *digitalis* produces such effects upon the nervous and digestive systems, as well as upon the heart, as to render its use objectionable. In such cases Prof. Bartholow advises the substitution of *cimicifuga racemosa*, half a drachm of the fluid extract three times a day; and he thinks sufficient attention has not been given to this remedy as a substitute for *digitalis* where a cardiac tonic is required. My own experience does not enable me to give an opinion of the effects of this remedy in these conditions. Doubt-

less strychnine alone, or in combination with digitalis, and various other preparations of iron and quinine, will in some cases act quite as beneficially upon the heart, or even more so than the particular combination of the elixir and digitalis recommended; but I think this mixture applicable to a larger number of cases than any other which I have seen tried, and my experience enables me to recommend its use with very great confidence.

A case appeared in the clinic of the University of Michigan more than three years previous to this writing, which has been under observation ever since, and has been witnessed by several physicians and a large number of medical students. The patient, a native of England, about thirty years of age, painter by occupation, was brought to the clinic in what appeared to be the latter stage of mitral insufficiency. The heart was very much enlarged, with its apex beat between two and three inches below and to the left of the nipple, with a very distinct apex murmur synchronous with the first sound. His respiration was exceedingly labored, his lips were blue, he was unable to lie down, his lungs were œdematous, there was general anasarca, the lower extremities enormously distended, and altogether his case appeared most desperate. He had had attacks of acute rheumatism some years before, with shortness of breath and palpitation of the heart progressively increasing since, and for some months past all his symptoms were much aggravated. He was given a few mild doses of hydragogue cathartic medicine, and directed to drink cream of tartar water; and soon was put upon the tinct. of digitalis and the elixir as advised above. He was soon somewhat relieved, and steadily improved in all his symptoms. In a few weeks his dropsy was all gone, he was able to be about and do light work; he gradually improved in strength, and after a few months was able to resume his occupation. The last time he was examined before the class, nearly three years after his first appearance, he was in apparent good health; the murmur still remained, but the heart had *decreased in size* very markedly, and he considered himself a well man. The heart had certainly contracted down to dimensions much less than when first seen. This I could but attribute to the effect of the remedies—increasing the tone and contractility of the muscular tissue, overcoming the dilatation, diminishing the relative insufficiency of the mitral valves, and restoring the compensatory action of the hypertrophied ventricle. I have seen other cases of a similar character, though less striking than this.

The second indication—the relief of various oppressed and deranged organs and functions, the result of the obstructed circulation—may in part be fulfilled by the same agents which improve the condition and action of the heart. These, however, often operate slowly,

and are ineffectual for the immediate relief of distressing symptoms, which may portend mischief of the most serious character.

When large accumulations of blood take place in the venous system, interfering with essential functions and endangering life, a venesection may be attended with prompt relief. This is seldom necessary, and may be followed, if large or repeated, by anæmia and debility and more rapid dilatation or degenerations of the heart.

Cathartics, diaphoretics, and diuretics are less objectionable, and when dropsical accumulations are present they are more efficient. From hydragogue doses of the saline cathartics, jalap and cream of tartar, or, more efficient still, elaterium, the dropsical accumulations will often rapidly diminish. If the strength is not too much reduced, the elaterium or other cathartics may be repeated and continued as long as they are well borne, or as the dropsical fluid remains. Diuretics, particularly digitalis in infusion, and for a time in free doses, often induce free diuresis, and other diuretics may be added or substituted according to the indications. Broom, juniper, cream of tartar, sweet spirits of nitre, etc., may be given. Diaphoretics, though generally less efficient, may still be useful, especially where the kidneys do not fully respond to the action of the diuretics. The warm water or steam bath may aid these means.

When the anasarca is excessive and does not readily subside, pricking the legs in numerous places with needles or pins not very sharp will often allow a free discharge of the dropsical fluid with great relief. More free incisions are sometimes followed by ulceration or even gangrene, and should therefore be avoided. Blisters or ulcers sometimes spontaneously appear, from which the dropsical fluid may be discharged, but they are often difficult to manage. Occasionally erysipelatous and gangrenous conditions appear, hastening a fatal termination.

Pulmonary œdema or inflammation will require the treatment already advised—reference always being had to the condition of the heart. Besides the means for the relief of œdema as it occurs in other situations, acetate of lead in free doses is strongly recommended for œdema of the lungs. For pulmonary inflammation produced by heart disease, as in other cases, free doses of quinine, warm poultices to the chest, etc., and, later, iodide of potassium, and such other measures as may be indicated, will be required.

The distressing dyspnœa which often occurs may be palliated by ammonia, the ethers, dry cups, etc. But as the dyspnœa is usually the result of venous congestion or œdematous effusion, a brisk cathartic will often afford the greatest relief.

The pains in the chest, not unfrequently present, will often be

relieved by a belladonna plaster, or different anodynes may be administered internally. Morphine is most efficient, but it must not be given so as to interfere with the elimination from the bowels so often required, and bronchorrhœa, which occasionally occurs and affords relief, should not be checked by its use.

The *third* indication, or that of improving the general condition of the system, is of much importance, and is in part to be fulfilled by some of the means already mentioned. The elixir of the phosphate of iron, quinine, and strychnine, improves the general tone of the system, and generally fulfills the important indication of improving the blood. In anemia all the morbid conditions are aggravated, and the dilatation and degenerative processes go on more rapidly. Different preparations of iron may be given, and various other tonics may be useful.

The stomach and bowels, the liver, and the spleen should receive attention, and all digestive derangements should, as far as possible, be corrected, and all sources of reflex irritation should be removed.

Improving the digestion and relieving anæmia will often relieve very decidedly the cardiac symptoms, showing that functional derangement, independent of the organic changes, may be added to the symptoms.

The not unfrequent occurrence of such complications should make the practitioner cautious and reserved in hastily pronouncing unfavorable opinions as to the continuance of life or the impossibility of relief, and should induce efforts at improvement of the general state, even when the local disease seems incapable of a favorable modification. All hygienic measures—a good nutritious diet, comparative rest, but gentle exercise in the open air, chiefly by driving—require attention. Tolerance of the disease may be promoted, and life much prolonged by judicious management.

Fothergill sums up many of the facts on this subject in the following conclusions :

“1. When heart disease exists with venous stagnation, there are many structural changes in the viscera below, which pathological changes are accompanied by manifestations of functional disorder.

“2. Though all functional disturbances may not be the direct results of the changes caused by heart failure, but have arisen from causes so-called accidental, still such disturbances are more readily produced where chronic heart disease exists than in persons structurally sound.

“3. In chronic heart disease the margin betwixt ordinary health and death is lessened, and consequently the limits within which disease may oscillate safely are diminished ; the range within which the pendulum may swing is smaller.

“4. Under such circumstances many trivial disorders, which in healthy persons may be left to themselves, must be promptly subjected to their appropriate treatment.”*

It should not be forgotten that some murmurs are quite innocent, that obstructive lesions may remain nearly or quite stationary for long periods, and that some recede; and as favorable a prognosis as possible should be given, so that all hope in the patient may not unnecessarily be destroyed.

HYPERTROPHY AND DILATATION OF THE HEART.

These conditions, though quite different in character, are so frequently associated together that they are usually considered in connection with each other.

By hypertrophy of the heart is meant an increase of its normal or nearly normal tissues. There is an increased growth of its substance, and in uncomplicated hypertrophy an augmentation of its contractile power.

The Histological change of true hypertrophy consists, according to Rindfleisch and other recent investigators, in the development of new muscular fibres having the same structure and endowment as those previously existing. It is probable that the cardiac ganglia have an increased development also. When a motor nerve supplying a muscle is irritated, the blood-vessels of the muscle are dilated, and more blood flows to the tissue; and through the influence of the trophic nerves, which are connected with the motor, the nutrition of the muscle is increased, if the general powers of nutrition are good. When the nutritive powers are feeble, such increased quantity of blood may lead to degenerative changes and atrophy of the proper tissue. In the latter case the mechanical pressure of the blood within the heart will lead to dilatation. When the excitability and the nutritive activity become exhausted, then dilatation follows hypertrophy; so that from the same causes, in persons of different nutritive activity, hypertrophy or dilatation may result.

When the muscular walls are increased in thickness and size, without alteration of the cavities, it is called *simple hypertrophy*.

When there is increased thickness of the walls, at the expense of the size of the cavities, it is called *concentric hypertrophy*. When there is increase of thickness of the walls, while at the same time the cavities become larger, it is called *excentric hypertrophy*.

Dilatation also has different forms. Enlargement of the cavities,

* Fothergill on Heart and its Diseases, pp. 101, 102.

while the walls remain normal in thickness, is called *simple dilatation*. When the cavities are enlarged, while the walls are increased in thickness, a condition identical with excentric hypertrophy exists, but from the stand-point of dilatation it is called *active dilatation*.

When the cavities are enlarged and the walls are thinner, it is called *passive dilatation*. This is the most common form, and the one generally understood when the term *dilatation* is used without qualification.

Causes.—These conditions have been referred to as the results of valvular lesions, and their conservative and pathological consequences have been noticed.

But there are other causes than valvular lesions which may give rise to these conditions, and some other effects than those already noticed may result from them. These require to be traced, and the histological changes, so far as understood, should be described.

In a majority of cases hypertrophy and dilatation—which in many instances are complementary parts of a single though complex process—are the results of some mechanical obstacle to the circulation. This may be in the heart, as we have seen—in stenosis of the openings, insufficiency of the valves, in chronic pericarditis and pericardial adhesions, or in myocarditis and new growths in the heart; though from these two latter causes the hypertrophy is not pure, and the dilatation is complicated.

The obstruction outside of the heart may be in the pulmonary circulation, in which case the right side alone is enlarged; or it may be in the aortic system, connected with the general circulation. Then the left side is primarily enlarged, but the right side also is likely to be ultimately involved.

The obstruction of the circulation through the lungs may be from emphysema, from fibroid degenerative changes, from long-continued pleuritic effusion, from stenosis of the pulmonary artery, either by disease of the artery or by pressure from without, from deformities of the chest or pressure of tumors upon the lungs or vessels—in short, from any cause which interferes with a free flow of blood through the pulmonary circle.

The causes of obstruction to the aortic or larger systemic circulation are various. Besides the narrowing of the calibre of the aorta itself from malformations, from growths within it, or pressure from without, from atheromatous degeneration, etc., obstructions in the branches of this great vessel may react upon the heart, and result in either hypertrophy or dilatation. Calcifications and senile decay; obstructive disease in various organs, particularly in the kidneys in some forms of Bright's disease; obstruction in the extreme circulation

from contraction of arterioles or capillaries temporarily, as in hysteria and other nervous derangements, or more permanently, as where irritation is for a long time kept up in the vaso-motor nerves; and whatever else may interfere for a long time with the free circulation of the blood through any of the important vessels or through the capillaries, will increase the blood pressure in the heart and tend to these changes.

According to Balfour,* syphilis is a cause of hypertrophy, but whether from obstruction to the circulation or from other conditions, he does not state. Many cases, he declares, yield to antisymphilitic treatment—the red iodide of mercury, or large doses of iodide of potassium. These agents, however, may remove other obstructions than those arising from syphilis.

But hypertrophy, and sometimes dilatation of the heart, may occur where no obstruction to the circulation is apparent or to be presumed. In cases of habitual overexertion, or long-continued nervous excitation, as in soldiers who have carried heavy weights on long marches, and have been subject to the excitements of an active campaign, hypertrophy and dilatation of the heart are frequently met with. Hypertrophy not unfrequently occurs in others who make extraordinary exertions, as those who wield a heavy hammer in restrained positions, colliers, stevedores, prize rowers, etc. In most of these cases some distention or moderate dilatation first occurs, hypertrophy follows, and not unfrequently a slow valvulitis, with contractions, obstruction, and a more serious increase of the heart's dilatation results.

Usually a nervous increase of the frequency of the heart's action does not result in material hypertrophy. Increased frequency of motions at light work, as in the pianist's hands, does not produce much enlargement; but increased force of work, as in the blacksmith's arm, develops the size of the muscles.

When the heart has obstructions which require more force to overcome, or when excited to more violent actions from any cause, hypertrophy is likely to follow. Stimulating food and drinks, strong coffee and tea, excess of spices, certain kinds of mental excitement, sexual excesses, as well as muscular overexertion may cause enlargement. Tobacco, depressing emotions, some reflex irritations, mental or physical excitements which cause rapid but feeble pulsations, produce irregularities and various derangements of the heart's action, and tend to produce degenerative changes and dilatation rather than hypertrophy.

* Clinical Lectures on Diseases of the Heart and Aorta, p. 303.

The same cause, however, in persons of different powers and susceptibilities may produce different effects. The occasional enlargement of the heart, of a neuropathic origin, without valvular lesions, is illustrated in some cases of Grave's disease (exophthalmic goitre) sometimes met with.

In rare cases hypertrophy and dilatation occur as the primary distinguishable morbid state, and are apparently idiopathic. Generally, however, they are secondary to some other recognizable pathological condition, or to some apparent cause. Such cause should always be sought for. The physical evidences of enlargement of the heart have already been pointed out, and need not further be dwelt upon. Some of the symptoms have also been stated, but such only as occur particularly in connection with obstructive lesions.

The **symptoms** of hypertrophy *without obstruction* are referable to the increased force with which the blood is impelled. That of the left ventricle is manifest in the general or systemic circulation, and that of the right in the lesser or pulmonary circle. In left-heart hypertrophy the pulse is strong and full, the face is flushed, there is often active cerebral congestion manifested by symptoms of pain, ringing in the ears, vertigo, a sense of fullness in the head, sometimes numbness, and often confusion of thought. The powerful action of the heart is felt even when the system is at rest, but custom may render it unnoticed. The arteries of the brain may become distended and weakened, and cerebral hemorrhage, with its consequences, may be induced. Other organs than the brain are more liable to be actively congested, and inflammatory conditions under other irritating causes are more likely to be induced or continued.

Hypertrophy of the right ventricle, without obstruction, is likely to produce active congestion of the lungs, and may lead to hemorrhage from those organs.

Dilatation, on the other hand, causes the blood to flow with less force to the brain and other parts, and is likely to produce symptoms of faintness, vacuity of mind, dimness of vision, drowsiness, etc. Failure of power will occur in other organs imperfectly supplied with blood; emptiness of the arterial system, with congestion of the venous, will produce changes of function in various organs. When the propelling power of the lungs is not sufficient to pump the blood from the venous system, dropsical effusions are a common result.

These various symptoms will point to the existence of hypertrophy and dilatation, but the physical signs can alone make the diagnosis complete.

Treatment.—Hypertrophy, when compensatory of obstruction,

will require no treatment. When it arises from other causes, such as have been pointed out, they should be removed, and measures are called for to prevent further growth and to obviate or palliate the consequences of overaction of the heart.

Blood-letting is called for only in exceptional cases when cerebral and other congestions are present, and the danger of hemorrhages or injurious effusions is imminent. Cathartics and other revulsive measures may be demanded, but depletion should not be carried to the extent of producing anemia, as that would usually render the excitability of the heart greater, and increase the inconvenience if not the danger. The excessive action of the heart may be moderated by sedative agents, such as aconite, veratrum viride, and hydrocyanic acid.

In the cardiac hypertrophy of soldiers, Da Costa found marked advantage from one or two drops of tinct. of aconite given twice or three times daily and continued in such doses for months. I have in a few cases found similar beneficial results from small doses of veratrum viride continued in a similar manner. Excitants of every kind are to be avoided, reflex irritations removed, and a moderate, temperate mode of life enjoined.

In predominant dilatation the indications are the same, whether from feebleness of tissue or mechanical obstruction. The nutrition, the tone, and the vigor of the heart, are, if possible, to be improved. A nutritious diet, and all the necessary means for promoting its digestion and assimilation must be advised. Digitalis, and elixir of the phosphate of iron, quinine, and strychnine, perseveringly used, are generally indicated, and active exertion and mental excitement must be avoided. Dropsical accumulations, if they occur, must be treated as in other cases of cardiac dropsy before described.

Codliver oil, ext. of malt, iron in different forms, various bitter tonics, etc., may be applicable in different cases, and often produce much improvement. A long and persevering course of treatment in the more favorable cases is generally required.

After dilatation is far advanced and is great, degenerative processes are likely to have occurred, the morbid effects are rapidly accumulative, and the end soon comes.

ATROPHY OF THE HEART.

By simple atrophy is understood a wasting or diminution of the substance of the organ, without special degenerative processes, and without dilatation.

In general wasting or marasmus, from whatever cause, the tissue of the heart is apt to be diminished with the rest of the system. In long-continued cachectic diseases, such as cancer or tuberculosis, atrophy of the heart is likely to occur. A congenital imperfection of development of the heart is sometimes met with, often in connection with other imperfect developments. Pressure upon the heart by effusions or tumors long continued, and atheroma or calcification of the coronary arteries, may interfere with its nutrition and produce atrophy. In uncomplicated stenosis of the mitral opening, less blood coming into the left ventricle, atrophy of that ventricle is apt to occur. In some cases of atrophy of the cardiac muscles the heart is covered with a layer of fat which may obscure the case.

Anatomically the wasted muscle has generally a brownish color, and, under the microscope, yellowish-brown pigment is found accumulated about the muscular nuclei. Such pigmentation, though to a less extent, is sometimes found in apparently healthy hearts. In general wasting of the body less blood is present, and less heart force is required to carry on its circulation, and the wasted heart is simply in harmony with the rest of the system. It is then of no clinical importance. In other cases it may lead to severe symptoms, attributable to failure of heart power, to general feebleness, syncope and death. Overexertion must be carefully avoided, and a general supporting course will be required.

FATTY HEART.

OBESITY OF THE HEART.—FATTY DEGENERATION.

By obesity of the heart, or fatty growth or deposit, is understood an accumulation of adipose tissue upon the surface or between the muscular fibres of the organ. It is apt to occur in corpulent subjects, in old persons, and in drunkards. The fat is found especially in the sulci, in the course of the coronary arteries, and generally more upon the right side than the left. A moderate accumulation is of little importance, but when excessive, even upon the surface, it may interfere with the heart's action; and if the fat penetrates the muscle and is infiltrated between the fibres, it may cause atrophy from compression, and the heart may become much enfeebled. In the earlier stages, however, the heart is enlarged by the presence of fat and the muscle may be well nourished; and in some cases, even to the last, there may be a full if not a strong pulse. There is sometimes a direct but gentle aortic murmur, from a thickened, fatty state of the semi-lunar valves, and the case may resemble aortic stenosis with hyper-

trophy. There will, however, be less heaving force in the ventricular contraction, the enlargement will be more toward the epigastrium than upon the left side, and the apex beat will not, as in hypertrophy of the left ventricle, appear to the left and much below the nipple.

Fatty degeneration is quite another and a much more serious affair. In it the muscular fibres are replaced by fat, and so far as the metamorphosis extends their power of contraction is lost. Fatty degeneration may be secondary to some previous disease of the organ, or it may be primary, and is then more likely to affect more or less all its parts, and is often accompanied by similar changes in other parts of the body. Indeed, in a large majority of cases where fatty degeneration is primary, or not the result of other forms of disease of the heart, there is a general tendency in the system to fatty changes. Various muscles, especially the diaphragm, and other organs, as the liver, are affected at the same time. The nervous system is involved in fatty changes, and with this occurs serous infiltration of the brain and nerves, producing variable symptoms. The nerves supplying the heart are affected, producing changes of innervation and nutrition in the organ. Anatomically the heart appears of a yellow color, but usually more in some parts than in others. This variableness is more in the inner layers, which present a mottled aspect.

Examined by the microscope, fat granules and globules are arranged in rows in the course of the fibres and within the sarcolemma, obscuring or obliterating the striation, and taking the place by metamorphosis of the albuminous substance of the muscle.

Symptoms, Causes, Diagnosis, and Prognosis.—The symptoms produced by this state of the heart are due to its loss of contractile power, and its consequent inability to carry on properly the circulation of the blood.

The arterial pulse, when the left ventricle is degenerated, will be feeble, and it is apt to be *intermitting* and otherwise irregular. It may be very slow or more frequent, and sometimes the apparent slowness is due to the fact that the cardiac contractions are too feeble to communicate a perceptible impulse to the artery examined.

Dyspnœa is a common and often a prominent symptom; paroxysms of fainting are likely to occur, accompanied by a sense of distress in the precordial region, the latter being generally due to distention from the blood which the heart is unable to expel. Sometimes there are paroxysms of severe pain extending over a larger space than the heart, often to the upper extremities—especially to the left arm. The so-called Cheyne-Stokes respiration occasionally occurs as a symptom of fatty degeneration. This consists of a short period of suspended respiration, succeeded by feeble and short inspirations

gradually increasing in strength and fullness to the highest degree, when they again regularly diminish until they reach the point of breathlessness, when, after a short pause, the paroxysm is repeated. This disturbed rhythm of breathing is not peculiar to fatty degeneration of the heart. It may occur in other cardiac lesions, and in uræmic poisoning. The dyspnœa, often taking other forms as well, is aggravated by bronchitis and œdema, which conditions are very likely to be present, especially where the disease is advanced ; and the dyspnœa may be entirely due to them.

Pseudo-apoplectic seizures, with a feeble pulse and cool and pallid surface, but not followed by paralysis, sometimes occur. Instead of cerebral pressure or hemorrhage, there is anæmia of the brain in these attacks ; and in some cases they are many times repeated. They may be fatal. Similar conditions to these may result from valvular lesions with dilatation, and the physical signs, with other circumstances, must be taken into the account in determining the *diagnosis*. In simple fatty degeneration the heart on palpation or percussion is not found to be enlarged, and its impulse and sounds are feeble, especially the first sound. This sound is not booming and prolonged, but short and valvular, resembling the second sound. The sounds sometimes resemble those of the fetal heart.

This disease occurs more frequently in men than in women, and oftener after fifty years of age than before. It may occur in lean persons, but it is rather more frequent in those inclined to corpulency. It is found in phosphorous poisoning, and in poisoning by various acids—sulphuric, nitric, phosphoric, oxalic, and tartaric. It has been found in chlorosis, and in other forms of anæmia, especially in women. It has in a few instances been found in young persons with recurrent hemorrhages. Alcoholism is another cause, and the result may be contributed to by various other debilitating and deranging influences. In all these cases there is a deficiency of vital and nutritive force, and a material lower in the scale, vitally and chemically, is the result.

Fatty degeneration of the heart not unfrequently occurs in acute fevers, and it is then rapid in its progress, and is often a cause of death in typhoid and typhus fevers.

There are often evidences of fatty change in other tissues, in the cases not dependent upon other heart diseases, as at the margin of the cornea or in the skin. The *arcus senilis* may occur without fatty disease of the heart ; but a general fatty change of the skin, shown by its yellow color, but without jaundice, in a person of light complexion, with feeble and deranged heart action, would point to cardiac fatty degeneration. In darker skins there is a want of lustre

and a greasy feel, as well as the yellowness indicating its degeneration. In making a diagnosis, the habits of the patient should be considered. Those accustomed to confinement, with little muscular exercise, and who are addicted to free living and to the habitual use of alcoholic drinks, are more liable to the disease.

When this affection occurs without valvular lesions—without hypertrophy or dilatation—by observing the conditions enumerated a diagnosis may be made with reasonable certainty. In my own experience, *post-mortem* examinations have confirmed opinions of this disease which the symptoms had enabled me to express. When other lesions are present it is more difficult to determine the existence of fatty change, as there are no positive diagnostic symptoms—none that may not be produced by other conditions.

The history and progress of fatty degeneration differ in different cases. In most the disease is insidious in the beginning, and considerable progress is made before tangible evidence of its presence is manifested. This is especially the case when it is preceded by hypertrophy. In other cases symptoms are earlier produced, and the progress is more rapid.

Fothergill, in speaking of this condition, says : * “Chronic alcoholism, especially when combined with syphilis, has a most malign influence. The chronic drunkard, who suffers for want of food, is the subject usually of a wide-spread and *rapid* premature decay.” The course in such subjects will be comparatively short. The clinical features of different cases will present varieties, as has already been intimated. Not only physical but mental symptoms are often produced. Dr. B. W. Richardson’s word painting of some of these cases is worthy of reproduction. He says : “The man or woman with a hesitating heart is thereby unfitted for sudden tasks, for demands or resolves which, when the heart is firm, are considered of comparatively little moment ; for, when the heart hesitates, the brain, which reposes for its power on the blood the heart supplies to it, falters with the heart, just as the gas flickers when the steady pressure is taken off the main. From these circumstances some persons, who once were known as resolute and determined, lose those qualities when they are subject to intermittent action of the heart, becoming, as their friends say, uncertain and doubtful in character ; becoming, as they themselves feel and know, less the master of themselves, and less secure in their own work and skill and power.” This account will apply to cases of other lesions, and even to functional derangements, and should induce the exercise of patience in dealing with them.

* The Heart and its Diseases, p. 219.

The usual course of fatty degeneration of the heart is progressive, and the termination is commonly in death. It may, however, be questioned whether this is always and necessarily the case. When it depends upon anæmia in young subjects, and is not too far advanced, by the removal of the anæmia, repair, at least, is possible. Degeneration, the result of acute fevers, is often repaired when the fever disappears. According to Rindfleisch, new fibrillæ are formed from cell-elements remaining within the sarcolemma.

The prognosis, as to the time of termination in those cases which are judged to be fatal, must often be a matter of great uncertainty, and will depend much upon the care and treatment the patient may receive. All the circumstances of a case must be well considered, the power of endurance estimated, and the rapidity of progress in the past must be taken into the account.

Treatment.—In general obesity, with fatty infiltration of the heart without degenerative processes, a diet should be prescribed with reference to the reduction of the amount of adipose tissue in the body. This subject has been discussed elsewhere.

“Bantingism” rigidly carried out is not altogether safe, since in some cases it induces other disorders which may do more harm; but an approach to that system in diet may be of essential service.

Exercise is important, and Kennedy advises the wearing of heavy clothing when exercising, to induce sweating as a means of reducing fat. Jockeys are said to reduce their weight by this means, often to a great extent.

Frictions and the warm bath are also advised. Some medicines have a reputation for reducing the amount of fat. Tincture of iodine and caustic potash are regarded as most efficient. Either of these must be given in decided doses to produce much effect.

Occasionally cases of decided plethora occur with fatty accumulations of the heart, and with a full and strong pulse. In such cases a low diet, saline purgatives, and sometimes even blood-letting, at least local if not general, will be required.

In *fatty degeneration* the indications are quite different. The object is to arrest the degenerative change, to remove the fatty débris within the sarcolemma, and to encourage the growth of new fibrillæ from the cell-elements still existing. Increased oxidation is desirable, and the patient should have as much fresh air as possible without being subjected to fatigue. In the anæmic cases especially, iron is indicated. The food should not abound in hydrocarbons, and alcohol is peculiarly objectionable. It diminishes the oxidation of fat, and favors fatty changes. Easily assimilated nitrogenized food should be taken in fair quantity. If either albumen or sugar appears in the

urine, even in small quantity, the omen is unfavorable, and reference must be had to the conditions they indicate in the treatment. Digitalis, with the elixir of the phosphate of iron, quinine, and strychnine increases the nutrition as well as the tone of the heart, and will often be useful. A general tonic course of treatment should be pursued. Carbonate of ammonia, spirits of chloroform, tincture of nux vomica, and digitalis, with potash or lithia, are advised by Fothergill. The first two, with other ethereal and various diffusible stimulants, are indicated for the fits of sudden depression so likely to occur. Every morbid condition of other organs and functions must receive prompt attention and appropriate remedies.

For the brain symptoms which are apt to occur, arising, it is supposed, from œdematous conditions, Kennedy advises a mercurial in alterative doses. He prefers it in the form of bichloride, and is confident it often stays the progress of the disease. The bowels should be kept free, and the kidneys in an active condition. Not only "false apoplexy," but real, serous apoplexy, often fatal, may occur. Revulsives, cathartics, and diuretics will be called for, and Kennedy advises both mercury and blisters where the case is not speedily fatal. Blisters may with propriety be tried, but I should prefer iodide of potassium to mercury, as being more efficient for promoting absorption of the effusion, and certainly safer.

In the congested and inflamed condition of the lungs and bronchi, free doses of quinine for a day, followed by the salts of ammonia, and perhaps by turpentine, will be indicated. Digitalis may be added to the other means. When the liver is congested and enlarged, a few mercurial doses, accompanied or followed by cathartics, will often procure much relief. The spanæmic effects of mercury must be carefully avoided, and in this, as in other conditions of lowered vitality, such effects are often readily induced.

But, above all things, all violent efforts and mental excitements must be avoided. Accidents about the patient must not disturb his equanimity, or call forth his exertion. He must avoid crowds and impurities of atmosphere. Sexual acts are dangerous. In one case under my observation mental excitement produced more severe effects than physical exertion. In this case sloughing of the gums and other parts about the mouth finally occurred, apparently from deficient circulation, and *post mortem* the heart was found extensively degenerated.

By observing all precautions life may sometimes be much prolonged and a large degree of comfort enjoyed. It is said that women, as a rule, survive chronic heart diseases longer than men.

PARENCHYMATOUS DEGENERATIONS.—FALSE
HYPERTROPHY.

There are other morbid and degenerative changes in the walls of the heart than the fatty ones.

Albuminous degeneration is sometimes found. The muscular substance is clouded, the striæ are defaced by granular albuminous matter instead of fatty matter. This is sometimes called granular degeneration and cloudy swelling. Some of the cases formerly described as softening of the heart are of this character.

This change usually affects the whole muscular substance. It is paler and softer, and the granules are not only pale, but dull, less glistening, and smaller than those of fatty degeneration. This albuminous material can be distinguished from fat by its being soluble in acetic acid but not in ether, while the reverse is the case with fat.

This form of change in the pre-existing albuminous substance is found chiefly after death from acute affections. Typhus, typhoid, puerperal, and exanthematous fevers, erysipelas, cerebro-spinal meningitis, pyæmia, and septicæmia, extensive burns, and poisoning from phosphorus and arsenic, are among the conditions which give rise to this degeneration. It may be developed very rapidly, is often found in connection with fatty degeneration, and may be, in some cases, a transition stage between the normal structure and the fatty condition. There is, however, thought to be no necessary connection between the two changes. This change, without doubt, occurs to some extent in many cases which end in recovery.

The symptoms and signs are those produced by diminished heart power, and this condition may be suspected when the heart failure in acute affections is out of proportion to other symptoms.

There will be diminution of the heart sounds, especially of the first sound, and a diminished impulse. This condition forbids the use of depressing agents, and requires supporting measures.

False hypertrophy is a rare affection, and consists of a development of connective tissue between the muscular fibrillæ of the heart. It is a hyperplasia, but of connective tissue instead of muscular structure, and is usually due to chronic interstitial inflammation. It resembles cirrhosis of the liver, kidneys, and other organs, and is dependent upon similar causes.

There are no signs or symptoms so peculiar to this lesion as to positively distinguish it from all others. There is, for a time at least, an increase in the bulk of the heart, and sometimes this is very decided, but there is an absence of evidences of increase of power.

The sounds of the heart are abrupt, and approach a "tick-tack" rather than the more booming normal first sound. The growth may not be general, and is usually greater in some parts than in others. A sort of scar texture is observed, sometimes in cords and streaks which ramify amongst the fibres or in more round-shaped masses; and, as in similar deposits and growths in other organs, contraction at length is likely to occur, the fibres become atrophied by pressure, and irregularities of form are seen, depressions appearing like deep cicatrices.

This lesion is interesting as a pathological rather than a clinical matter, as it is seldom positively distinguishable from the fatty changes. Still, when fibroid hyperplasias are present in other organs, and heart symptoms are manifested, and especially if there have been preceding symptoms of myocarditis, we may presume that a similar state of the heart exists.

When advanced it is incapable of removal; but in the unsuspected earlier stages the iodide of potassium might be tried, as in other cases of fibroid hyperplasias.

Amyloid degeneration of the heart rarely occurs. It does not differ anatomically from amyloid degenerations elsewhere, is found usually in connection with this change in other organs, as the liver, spleen, or kidneys, and is attended by failure of heart power.

Syphilitic gummata may affect the heart in the subjects of this constitutional disease. They do not differ from these deposits in other muscles, and may be suspected when failure of heart power occurs in chronic syphilitic patients.

The treatment is that of syphilis, and especially consists in giving free doses of iodide of potassium; but treatment must be instituted early to be efficient. Heart tonics as palliatives may be required.

Tubercles may affect the heart walls when occurring in other organs, especially the miliary variety, in acute tuberculosis.

Cancer in its various forms has been found to attack the heart. In one case coming under my observation a few days before death, a soft cancer was found at the autopsy involving the left auriculo-ventricular opening and the mitral valves, which were completely destroyed by a necrotic process. This was primary, as no cancerous growth was found in any other part of the body. These cases cannot be remedied, and their diagnosis is obscure.

Other new growths and various parasites are sometimes found in the heart, but they have no definite clinical history, and are not susceptible of curative treatment.

Rupture of the heart has been referred to as an occasional result of abscesses and aneurism. It may also occur from fatty and other forms of degeneration, and is much more likely to happen in persons advanced

in life. Thrombosis or atheroma of some of the coronary arteries is likely to result in degeneration or necrosis of the parts of the heart supplied by the occluded or diseased arteries, and such parts may yield to the pressure of the blood in the cavity and a rupture result. It may occur with or without some extra exertion, and is commonly speedily fatal. Should the patient survive a sufficient time to manifest symptoms, there would be likely to be severe pain and shock, a sense of fullness in the region, and evidences of loss of blood; and the heart's action would of course be impeded. These symptoms would come on suddenly, and commonly in the midst of some muscular effort.

Cases of this kind sometimes present questions in medical jurisprudence. In a case of death from a ruptured heart at the time of a railroad accident or of an assault, giving occasion for a civil or criminal suit, the question will arise as to the agency of the accident or the assault in producing death. A case came within my knowledge of a trial for murder, where an assaulted party, an old man, fell dead in the midst of the encounter.

On *post-mortem* examination a part of the wall of one of the ventricles was found of extreme thinness, and ruptured. The question of the extent of criminality was a very perplexing one to the jury, but a verdict of manslaughter was rendered, followed in a few months by an executive pardon. Cases of this accident may thus have not only a pathological but a legal interest, and the fact that spontaneous ruptures, or ruptures under physical or mental excitement, sometimes take place should be understood.

Polypoid tumors sometimes are found in the interior of the heart. The vegetations described as the result of endocarditis may become persistent and assume the character of polypi. Such growths probably may occur without inflammation. They may give rise to murmurs and obstructions, but are beyond the reach of curative agents.

Thrombosis of the heart and emboli of the pulmonary artery are conditions frequently met with *post mortem*, and these are sometimes called false polypi. Most of these heart clots are formed in the article of death or afterward, and have no clinical character; but some are formed in time to produce symptoms and may be an immediate cause of death.

The distinction between ante-mortem thrombi and post-mortem coagula should be made.

“The ante-mortem thrombi are of a whitish, yellowish, or reddish-gray color, dull in appearance, adherent to the heart-wall, often friable in consistence, laminated in structure, and with the free surface

usually rounded. The central portion of the older thrombi is often broken down into a creamy mass, which was formerly mistaken for pus, and such thrombi were called puriform. This creamy mass consists chiefly of granular material. The thrombus itself is composed mostly of fibrine and white blood corpuscles, and belongs to the so-called white thrombi described accurately by Zahn." (Flint.)

The *post-mortem* clots are sometimes simply clotted blood of a dark red color, and varying in firmness.

They are often in part destitute of red corpuscles, but the more depending parts of the clots contain them.

The blood may coagulate so slowly that, as in the formation of the "buffy coat," the red corpuscles sink, leaving the white, which are specifically lighter, entangled in the fibrine at the top of the clot. These decolorized *post-mortem* clots are yellowish white at the top, are more juicy than firm in structure, are loosely attached to the heart-surface, and generally extend into the pulmonary artery and its branches.

When thrombi are formed, as has been seen sometimes to be the case in other diseases (inflammations and fevers), they produce obstruction to the circulation of the right side of the heart, and are generally the forerunners, if not the cause, of speedy death. Besides symptoms of obstructed circulation through the right side of the heart, tricuspid systolic murmurs may sometimes be present, where a short time before they were absent.

These symptoms and signs taken together may make the diagnosis fairly positive; but often no murmurs are heard and the symptoms are not characteristic.

When thrombi in the heart are suspected, absolute rest should be enjoined, ammonia should be freely given, and general sustaining measures will be indicated.

Whether recovery ever takes place after the formation of large thrombi is uncertain.

Embolism of the main trunk of the pulmonary artery may obstruct the flow of blood to the lungs and cause speedy death. Such emboli may be from the heart or any of the large veins. Sudden, urgent dyspnoea from pulmonary arterial obstruction would occur; cyanosis, cold extremities, a small, rapid, and feeble pulse, and usually death would soon follow.

Professor Flint, however, in his "Clinical Medicine," mentions two cases of complete obstruction of one of the primary divisions of the pulmonary artery, which was found *post mortem* to have been firmly plugged up for a long time with calcareous emboli; no serious symptoms had been induced by this, and death occurred from other causes.

We have now had under consideration all the organic diseases of the heart which have a distinct or well-recognized anatomical or clinical history, and are prepared to consider those functional disorders which are more frequent than the organic. They are not, however, so well defined, and may be disposed of in a much shorter space.

In reviewing the ground over which we have passed, regarding the subject from a strictly clinical stand-point, we may notice, following the classification of Prof. Sée, of Paris, three divisions of cases, viz.:

1. Those which present a complete train of rational symptoms and physical signs, and which may therefore be termed *typical forms*.

2. Lesions purely anatomically characterized, where there are physical signs without functional derangements, and with or without compensative hypertrophy. These may be called *anatomical forms*.

3. Abnormal cases, where physical signs are wanting, and the rational symptoms are more or less incomplete. These may be termed *obscure forms*.

Regarded symptomatically, it will be observed that of the organic diseases of the heart there are (1.) pulmonary varieties—(a) dyspnoic, continued or paroxysmal, and (b) hemorrhagic. (2.) Hydropsic varieties—(a) the common form of anasarca, (b) simple initial œdema, and (c) general dropsy, cardiac and nephritic. (3.) Cerebral varieties, often with visual troubles. (4.) Exophthalmic goitre, or Basedow's disease. This last is a peculiar affection, which will require a separate consideration.

FUNCTIONAL DISEASES OF THE HEART.

By functional diseases of the heart, as of other organs, is meant morbid disturbances of action without material or perceptible changes of structure. In these affections there are morbid activities of various kinds, independent of inflammation or any of those organic lesions which have been the subjects of the preceding accounts.

They may be arranged into several groups. Sée divides them into (1.) Arythmic. (2.) Intermittent and (3.) Palpitating forms. (4.) Painful affections—Angina Pectoris and Cardiodynia; and (5.) Syncope. To these may be added (6.) greatly increased frequency of pulsation, and (7.) greatly diminished frequency of the pulse. There are, besides, many kinds of morbid sensations, not amounting to pain, but which are annoying and alarming to patients. The different particular phenomena enumerated are combined in various irregular proportions in different cases, and thus great varieties of particular symptoms are produced.

A loss of the regular rhythmical movements of the heart is frequent. In health there is a great degree of uniformity in the length of the different movements, and in the time of their recurrence. In arhythmic disorders this uniformity and regularity are destroyed.

At one time the individual contractions are quick and irritable, and occur in rapid succession. At another time the individual contractions are longer or slower, and less frequent in occurrence, and these fluctuations take place within short periods. At one moment there may be an agitated "fluttering," which soon will be less or quite absent. These changes are commonly attended by morbid sensations, often with decided distress.

Intermittence of the heart-beat is not unfrequent. Proceeding with considerable regularity for several beats, one will be omitted, and often a heavy and conscious pulsation, sometimes painful, will follow. Occasionally, every second pulsation at the wrist will be absent, though there is a slight contraction of the heart, each alternate one not being of sufficient force to send a perceptible wave to the artery. Oftener, however, the heart omits a revolution of its action, more or less frequently, while its force may or may not vary at the same time.

When the heart-beat is plainly felt and heard by the patient, *palpitation* is said to occur. This is usually produced by more forcible pulsation of the heart, but sometimes it is the result of increased sensibility, so that pulsations of ordinary force are distinctly perceived. Generally, in hypertrophy, the patient is sensible of his heart-beat when he gives it his attention; but often, though its action is very forcible, he becomes so accustomed to it as not to be conscious of anything unusual.

Sometimes each pulsation is not only felt, but gives pain; but more frequently painful sensations of a darting, shooting, or more persistent character are felt in the region of the heart, and are more or less diffused or radiated from that point. This pain in the heart is sometimes called cardiac neuralgia or hyperæsthesia, or *cardiodynia*. It has different degrees of severity, and is commonly intermittent or remittent.

Angina Pectoris is a term applied to an exceedingly painful but rare paroxysmal affection, which oftener occurs in connection with organic diseases of the heart or aorta, but sometimes where no structural change is distinguishable. This will soon be considered.

By *Syncope*, in this connection, is understood temporary suspension of the heart's action, or at least the occurrence of such feeble action as to cause a loss of power and more or less complete unconsciousness, from a deficient supply of blood to the brain. Syncopal

attacks may be complete or incomplete, and, like other functional derangements, may be induced by a variety of causes, and often by mental impressions.

Greatly increased frequency and greatly diminished frequency of pulsations need no definition. These changes are usually accompanied with modifications of force—sometimes increased, but oftener diminished.

Prof. Flint has reported cases of slowness of the heart-beat down to forty, or even twenty-six per minute, not associated with organic disease, temporary in duration, accompanied with more or less cerebral disturbance, but not with organic cerebral lesions. He regards them as connected with some centric nervous condition, which affects the heart through the inhibitory function of the pneumogastriacs.

Most of these affections are not only functional, independent of ascertainable structural disease, but neuropathic changes of innervation, causing the modified sensations and actions of the heart.

These different functional derangements of the heart are combined in a great variety of aggregates of subjective phenomena. Palpitation, pain, a sense of fluttering, of heart struggling, of sinking, of faintness, of suffocation, and even of impending death, may be experienced. They are paroxysmal, and give rise to alarm and mental anxiety more than do organic diseases. Mental causes, apprehension of severe organic disease, and fear of sudden death, increase the symptoms, and it is often very difficult to satisfy the patient of the character of the affection.

Causes.—The causes of these functional derangements are various. High living and deficient exercise, in persons of full habit and abundant blood, are sometimes a cause. But these derangements more frequently occur in anæmic persons. Intense or long-continued mental anxiety, excessive mental application, a melancholic depression, derangements of digestion, constipation of bowels, retention of excretions, oxalæmia, and particular dietetic errors are among the common causes. Tobacco and strong tea and coffee are fruitful sources of these disturbances. They are often present in gouty persons, and are produced by the various causes which induce gout. They are often associated with uterine and other genito-urinary affections, and not unfrequently with “spinal irritation.” They are very often sympathetic and reflex, and all their causes act upon or through the nervous system—sometimes upon the pneumogastriacs, sometimes upon the sympathetic, and sometimes upon the proper ganglia and nerves within the heart.

Diagnosis.—To distinguish between merely functional derangements and organic lesions with functional disturbances, is exceedingly important and not always easy.

The evidences of the different forms of structural disease have perhaps been sufficiently dwelt upon, and must be borne in mind. Various matters in the history and course of the cases will aid in the diagnosis. In a majority of valvular diseases, a history of rheumatism, of Bright's disease, or of endocarditis from some cause, has preceded. The symptoms of these structural changes when once established are commonly persistent, though aggravated at times, and are usually progressive. Active exertion always increases them. Severe symptoms seldom come on when the patient is at rest.

In functional affections a history of preceding endocarditis, or of other inflammatory attacks of the heart, is usually absent. The symptoms are intermitting and variable—greatly influenced by other present conditions of the system. Paroxysms frequently come on when the patient is at rest, and are not unfrequently relieved by somewhat active exertion. When paroxysms of suffering are not present, very active muscular exertion may occur without unusual dyspnoea or palpitation. In real organic disease the patient is less apprehensive, is reluctant to admit, and sometimes conceals his symptoms. In functional derangements apprehension is greater, advice is more readily sought for, symptoms are obtruded and dwelt upon, and trivial ones are sometimes magnified. A fit of dyspepsia, a bit of bad news, a sudden surprise, and other and more slight agitating causes, will usually greatly increase the symptoms, though sometimes the complete arousing of the attention and diversion of thoughts will cause the patient to forget his heart and his fears.

But a physical examination alone will satisfy the careful physician. If the apex beat is in its proper position, if there is no enlargement of the heart, if no murmurs are heard, or only those which are dynamic or hæmic—those which are direct with their site at the base, and are variable in amount—valvular disease may be excluded. A favorable opinion may be expressed, and if this be done with intelligent authority, the patient may be saved an immense amount of mental suffering.

Indecision on the part of the physician will be construed by the patient as an unfavorable opinion, and no honest and valuable opinion can be confidently expressed without a knowledge of the principles of physical exploration and some skill in their application. However easy it may be to determine the existence or non-existence of valvular lesions, it is not always easy to distinguish between fatty degeneration or obstruction of the coronary artery and severe cases of functional derangement.

There are no physical signs, especially in the early stage of fatty change, which are characteristic, certainly none that are pathognomonic

of that lesion. In fatty degeneration, serous effusion into the matter of the nerves supplying the heart may occur at the same time with the change in that organ, and this may produce a variety of heart symptoms resembling those of mere functional origin. But as fatty change advances, evidences of organic disease increase, the failure of power becomes manifest and is constant, evidences of fatty degenerations in other organs occur, the disease is usually progressive, active palpitation is not felt, loud heart sounds are not heard, and calcareous deposits may follow. The patient at no time can take active exercise without dyspnoea and being obliged to rest; pseudo-apoplexy—a sudden fall and loss of consciousness, with pale face but without spasm or paralysis, and with a speedy recovery—is apt to occur; and other cerebral symptoms, as slowness of thought and speech, frequent falling asleep, and weight and pain in the head, are apt to take place.

Serous effusions in the areolar tissue are often observed, but they are not extensive, though sufficient fluid may be poured out in the brain to cause a fatal serous apoplexy. As the degeneration goes on, and especially when it affects other muscles and tissues, paralysis or rather great weakness in various parts comes on; animal heat is diminished; the face puts on the appearance of age, and presents the color of a faded leaf; the nares are moved in respiration; the breath is short; the speech deliberate; congested lips, cheeks, and ears are noticed; the “Cheyne-Stokes” respiration may take place; bronchitis, pneumonia, œdema, or hemorrhage of the lungs may supervene; constipation, and finally diarrhoea may set in; the kidneys become involved; the pulse is sometimes very slow, oftener rapid or intermitting; sometimes angina pectoris occurs; and death, sooner or later, closes the scene. No such progressive and serious consequences follow functional heart diseases, though much suffering may be entailed during a long life.

Treatment.—The treatment of functional heart diseases is divided into the palliative measures for relieving the immediate symptoms, and the more radical or curative measures for preventing their recurrence. Both the palliative and curative measures will vary according to the particular symptoms and the general condition of the system.

In persons of full habit, well or rather over nourished, with strong palpitating action of the heart, cardiac sedatives—*veratrum viride*, *aconite*, a restricted diet, purgatives, perhaps a moderate bleeding—will be the means indicated for immediate relief. In cases dependent upon irritating materials in the stomach, an emetic may be needed; if there is constipation, a cathartic; if acidity of the stomach, an alkali should be given, etc. If the patient be anæmic, debilitated, and

irritable, the heart beating rapidly but more feebly and irregularly, cordials and antispasmodics will be indicated. Ammonia, ether, warm drinks, camphor, Hoffman's anodyne, valerian, valerianate of ammonia, etc., will fulfill the indications.

Opiates and alcoholics often produce temporary relief, but the secondary effects of the opium are often unpleasant. When either of these articles is left to be used at the discretion of the patient, there is always danger of the establishment of habits infinitely worse than the disease they but very temporarily relieve.

But these palliative measures are far less important than the curative. These will depend upon the causes and the general state of the system, or of particular organs which may affect the heart through sympathy. Every morbid condition should be remedied, and every cause removed. If there be over-eating and drinking, plethora and want of exercise, these conditions must be remedied. The remedies suggest themselves without being mentioned.

The diet must be restricted, saline purgatives must be given, and exercise enjoined.

If there be gastric catarrh—a condition often present—Carlsbad water or other salines will be indicated, or such other measures as the symptoms demand. If there be other dyspeptic conditions, or derangements organic or functional of the stomach, bowels, liver, kidneys, pelvic organs, or any other parts, they should receive appropriate attention. Anæmia particularly should be met by iron, perhaps arsenic or other tonics. If there is oxaluria, nitro-hydrochloric acid will be required. In short, every morbid condition of the system should receive its proper attention and correction.

Many cases will be completely cured, and a load of wretchedness removed, by discontinuing the use of tobacco. Others, especially women, will be cured by abandoning tea or coffee, or both; others by avoiding excesses, sexual or otherwise; some by change from an indoor to an outdoor occupation. A change of climate will relieve others. Digitalis in moderate but continued doses, with tonics—none better than the elixir of the phosphate of iron, quinine, and strychnine—will increase the tone and diminish the irritability of the heart in functional as well as in organic diseases. I have often found this combination useful, especially in the functional, and in possibly beginning fatty hearts of the aged. In cases of intermittent, irregular, and convulsive action of the heart, with sensations of faintness and frequent distress and fear of speedy death, I have often prescribed this mixture to be taken and persisted in, with perhaps occasional intermissions, for weeks and months, with the effect of giving an apparently new lease of life, of comfort, and of usefulness.

The frequency with which tobacco causes functional derangements of the heart, renders a more particular mention of the subject proper.

The "tobacco heart" is now recognized by those who have experience in this class of diseases. Its beat is usually frequent and irritable, but generally not strong, and there are frequently irregularities in its rhythm, and sometimes it is perceptibly dilated. Its irregularities are often associated with irregularities of respiration, with an anæmic state, and with a variety of uncomfortable and sometimes very distressing sensations. The remedy here is the discontinuance of the poison, and this is usually sufficient to restore the normal conditions, if the indulgence and the disease have not continued too long. Sometimes tonics are required to improve the impaired tone of the system.

Strong tea and coffee not unfrequently produce somewhat similar effects, and their discontinuance is followed by similar beneficial results. Cases of this kind have too frequently come under observation to leave any doubt as to the injurious effect of these articles upon many hearts, and the benefit derived from their abandonment will often be very striking.

The functional derangements which accompany organic diseases of the heart will require attention, but the treatment will be more or less completely merged into that for the organic lesion.

ANGINA PECTORIS.

This, as already mentioned, is a painful paroxysmal affection, the pain having its seat in the region of the heart, but extending to different situations, to both sides of the chest, to the left shoulder and arm, sometimes stopping at or before reaching the elbow, at others extending to the forearm and fingers, sometimes to the right arm also, and rarely to the lower limbs; and not very unfrequently it shoots up into the neck, the face, and the temples.

Generally more or less numbness is felt in connection with the pain, and rarely in some parts a numbness is felt without the pain, and the degree of violence of the pain and the extent of its radiation vary in different cases.

As the phenomena are subjective, except the sudden death which sometimes terminates a paroxysm, the exact character of the suffering is difficult to ascertain, and still more difficult to describe. In most cases the agony of suffering is represented by the patient as intense, and besides the pain there is a *sense* rather than a fear of dissolution; a feeling of oppression, of fullness in the region, or of suffocation, which is described as unbearable, and, indeed, would be, if continued a

great length of time. The distress reaches its height in a few minutes, and sometimes subsides as soon, but uninfluenced by treatment it may continue in the less violent cases for some hours.

The suffering is aggravated by motion, and the patient usually seizes some near object to hold himself still, and restrains the motions of breathing for fear of increasing the pain. When one attack occurs, others usually follow, but at irregular intervals, and sometimes they become more and more frequent to the end. Angina pectoris is often connected with organic disease, especially of the walls of the heart, fatty and other degenerations, obstruction of the coronary arteries, the aortic valves and opening, or of the aorta ; but sometimes no structural disease is discovered ; and no particular known lesion is essential to its existence. It must therefore be regarded as neuropathic—perhaps neuralgic—and Trousseau considered it epileptiform.

Professor Potain, of Paris, makes three varieties of the disease—one depending upon disease of the coronary arteries, one entirely a neurosis, and the other dependent upon some chronic disease, generally valvular, with enlargement. Fatty degeneration is not particularly mentioned by him, but this is certainly among the causes.

The *Diagnosis*, in any cases approaching the typical form, cannot be difficult ; and the *Prognosis*, so far as a cure is concerned, is unfavorable.

The course varies in different cases, but in those connected with organic disease, sudden death in a paroxysm is liable to occur. Some cases with occasional paroxysms linger many years, but the tenure of life in this disease is very uncertain, even when no organic disease is discoverable.

Well-marked cases seldom continue more than six or seven years after the first paroxysm. In some cases resembling the genuine, life continues much longer. In occasional cases of severe paroxysmal cardiac distress recovery takes place.

Angina pectoris is more frequently associated with gout than with any other general disease ; and in the gouty cases organic changes are likely to be present. The kidneys may also be affected, and the arteries of the brain are apt to be involved. In these cases the danger is great. The prognosis is favorable only in pseudo-angina, where the real disease is intercostal neuralgia, hysteria, spasmodic dyspnoea, or like affections.

The cases are more likely to be fatal where there are organic changes, which are more difficult to diagnose. An unfavorable result is more common, and generally more speedy, in fatty metamorphosis and calcified coronary arteries than in valvular lesions and other more detectable changes.

Among the *Causes* of angina pectoris are reckoned organic disease of the walls of the heart, of its openings, and of the aorta, gout, advanced age, want of exercise and indulgence in wine, and any of the causes tending to produce fatty degeneration.

The *Pathogeny* of the disease has given rise to differences of opinion, and all of the conditions are not positively established.

From its first accurate description it has been regarded as a neurosis, and the pain and other symptoms have been thought to be the result of spasm. It is generally spoken of as a visceral neuralgia, though some have thought it to be a hyperæsthesia of the solar plexus. Such hyperæsthesia doubtless sometimes exists, but it does not give rise to the full phenomena of angina pectoris, and has not its dangers. At present it is understood that during a paroxysm there is *increased arterial pressure and diminished pulse-wave*. There is apparently *spasm* of the vessels through the system from irritation of the vaso-motor nerves. This produces obstructed blood flow through the smaller vessels, and a collection of blood within the heart and distention of its cavities; and Dr. Flint is of the opinion that by over-distention the heart is paralyzed, producing the fatal effects so apt to take place. The pain is probably situated in the heart nerves themselves, rather than in the solar plexus, and motor as well as sensory changes take place, resulting in suspension of action in the fatal cases. Ganglionic nerves in other viscera, as in gall-stones in the liver and irritating substances in the intestines, are capable of producing severe pain, and the same is doubtless true of the ganglionic nerves of the heart. The inhibitory nerve filaments from the spinal accessory in the pneumogastric nerves are probably concerned in arresting the heart's action; but paralysis of the sympathetic would produce a similar result. The question has arisen as to whether, in the arrest of the heart's action in these cases, the organ is paralyzed in diastole or in spasm in systole. Arrest of the circulation would equally result in either case. It is well established that the nitrite of amyl, by diminishing the action of the vaso-motor nerves, dilates the blood-vessels. This causes them to be readily filled with blood from the heart, thus unloading that organ; and this article remarkably relieves the symptoms of angina pectoris. It is inferred that in this disease there is spasm of the vessels which the nitrite of amyl overcomes, and that in this manner the symptoms are relieved. It is possible, however, that this powerful agent acts directly upon the sensory function as well as upon the motor, in producing the relief which follows its use. The effect of this article upon the disease is regarded as throwing light upon its nature, but the obscurity of its pathogeny is not entirely removed. Its neurotic character is shown by the fact

that some are in apparently fair health and can take active exercise between the paroxysms, and within a short time of the fatal one.

In some cases cerebral attacks coincide or alternate with the cardiac paroxysms. These are marked by giddiness, temporary coma, disorders of sensibility, spasms, and rarely paralysis, pointing to vaso-motor neurosis and irregularities of the cerebral circulation.

Treatment of Angina Pectoris.—This is naturally divided into that of the paroxysms and that during the intervals.

For the distress of the paroxysm, opium, or rather morphine hypodermically, alcohol, spirits of ammonia, Hoffman's anodyne, sulph. ether, musk, camphor, ether by inhalation, warmth to the extremities, sinapisms to the chest, epigastrium, and limbs, mustard pediluvia, etc., are among the remedies which have the sanction of long-established authority. Chloral hydrate by the stomach, and chloroform by inhalation have been used more recently, and often give prompt relief; but sometimes, it is feared, they may have produced fatal effects. They should at least be given with much caution. The *nitrite of amyl*, it is found, produces the most prompt and complete relief of any known agent. Five drops, a little more or less, inhaled from a bit of lint or a handkerchief held over the nostrils, will generally produce almost instant relief. In severe cases the inhalation should be continued without interruption until the face is flushed, indicating relaxation of the extreme vessels. Patients subject to these attacks, who have learned its use, may carry with them a limited quantity of the medicine and inhale it cautiously, perhaps directly from the vial, on the approach of a paroxysm. The safest and most convenient method of using this powerful medicine is by having it in thin glass capsules, containing a given amount—three to eight drops—to be crushed in a handkerchief and inhaled as required. When it is taken with sufficient promptness, the development of a paroxysm may often be prevented.

When the venous system is much congested, moderate blood-letting, dry cups, or, perhaps better still, ligation of the extremities, may relieve the right side of the heart, otherwise greatly oppressed. The galvanic current, with the positive pole near the lower end of the sternum, and the negative over the lower cervical vertebra, is said to have produced marked relief. Aconite and veratrum viride are contra-indicated.

The treatment in the *intervals* must be conducted on general principles, after as complete a diagnosis as possible has been made. All influences tending to produce a paroxysm must be avoided. Over-exercise, mental excitement, too much or improper food, constipation,

much venereal indulgence, the use of tobacco, and the habitual use of alcohol, must be abstained from.

Associated morbid conditions should receive attention and be treated according to their character and indications.

The particular remedies that have been used for this disease in the intervals of the paroxysms are Carlsbad and other aperient waters moderately, iron, strychnine, digitalis, phosphorus, belladonna, and *arsenic*; the last article having much testimony in its favor. The bicarbonate of soda, used in large doses, but omitted from time to time, has been recommended in some cases, and the bromide of ammonium has also been advised when much irritability is present.

When organic disease exists it must be treated on the principles already described, different forms requiring different management.

In aneurism of the aorta the iodide of potassium in large doses—twenty to thirty grains two or three times a day—is said to have, in many cases, most wonderful effects, and is certainly worthy of a trial. It is also advised in cases where atheroma or other obstructive disease of the coronary artery is suspected.

EXOPHTHALMIC GOITRE.—GRAVES' DISEASE.

This is a functional disorder of the heart, generally consisting of rapid and violent movements, associated with enlargement of the thyroid body, and a peculiar prominence of the eyeballs.

The three events—enlargement of the thyroid, prominence of the eyes, and derangement of the heart's action—have some pathological connection, the nature of which is not fully understood. The phenomena of this disease are marked and characteristic. In examining a fully developed case, the prominence of the eyeballs will first attract attention. It is present in different degrees, but is sufficient to give a startled expression, a large portion of the sclerotic coat being visible; and sometimes the projection is so great that the eyes cannot be covered by the lids; and in the last case of the disease which came under my care, one of the eyes, from continued exposure, had become ulcerated and so much disorganized as to require enucleation. A want of co-ordination between the movement of the eyeballs and the lids is often noticed. In looking downward, especially, the eyes move without the lids; but aside from the prominence and this peculiarity of movement, the eyes are natural in appearance, and unless inflammation from exposure occurs, the vision is not materially affected. One eye may project more than the other, but both are almost invariably affected, and generally equally so.

The thyroid body is noticeably and sometimes very prominently enlarged, and often most on the right side. It does not, however, become as large as in many cases of common goitre; and neither the tumor nor the eyes are usually painful, though the eyes often feel as if they were being pushed from their sockets. Breathing is seldom interfered with, but the voice is sometimes affected by the pressure of the goitre upon the recurrent laryngeal nerve. The thyroid vessels are enlarged as in other goitres, and the arteries often pulsate with much greater force. The enlargement is due in a great degree to the distention of the vessels, and is often markedly variable in amount at different times.

The increased action of the heart is a primary and an important feature of the disease. The pulsations vary from one hundred to one hundred and fifty in a minute, and are generally so forcible as to be sensibly felt by the patient. There are not unfrequently blowing sounds at the arterial orifices, and occasionally there are evidences of valvular lesions. Enlargement of the heart, especially where the disease has long continued, is not uncommon.

Anæmia is present in most of the cases, but not in all. In some cases which have come under my observation there were no appearances of this condition; and in one, an unmarried woman of about twenty-five, there was actual obesity and apparent plethora. A variety of neuropathic symptoms are commonly present, such as irritability, sleeplessness, and hysteria; and often the appetite is capricious, and digestion is affected, and both anæmia and emaciation are apt to follow.

In women—and a majority of the cases are women—menstrual derangements often occur, and cases are reported of the enlargement of the mammæ. The worst case, however, which has occurred in my experience, the one referred to where an eye was removed, was in a delicate young man.

In the early stage the goitrous enlargement may be very slight, and the projection of the eyes inconsiderable, the principal symptoms being the increased action of the heart, and the pulsations in the vessels of the neck. In these vessels murmurs are sometimes heard, as well as in the heart.

The disease usually continues for years, with some increasing and with others diminishing in severity; while in a moderate proportion of cases recovery takes place.

The disease is seldom directly fatal of itself, but patients are apt to be cut off by intercurrent affections, which have sometimes more than an accidental relation to this peculiar affection.

The pathology of this disease is obscure. It has sometimes occurred after fright or some intense excitement, but the causes of this affection are as obscure as its pathology. Its neuropathic character must be admitted, but this explains but little. Even the anatomical cause of the projection of the eyes is not entirely established. It has been attributed to the accumulation of fat in the sockets, an increased quantity of which is said to have been found there; but it has been observed that after death the prominence disappears. The projection is probably due to distention of the vessels in the sockets; but it is not easy to understand how so great a protrusion as sometimes occurs can be effected by the few vessels found in that situation. The prominence of the eyes and the enlargement of the thyroid are consecutive to the increased heart action, and sometimes there is an increased action of the heart continuing long and apparently of the same kind, without the other events or with only one of them. The seat of the neuropathic condition has been supposed to be either in the cervical portion of the spinal cord or in the medulla oblongata, but no anatomical demonstrations have as yet been made.

Treatment.—The functional disturbance of the heart, the morbid states of the nervous system, and the anæmia so often present, afford the chief indications for treatment. No specifics for this affection have been discovered. Opinions have differed as to the utility of some particular remedies. Some have advocated and others condemned the use of iodine for the enlarged thyroid. Iron, especially in the anæmic cases, has been strongly recommended by some, but has been regarded as injurious by others, particularly by Trousseau and Von Gräfe. Arsenic has had its advocates and opponents. In two cases reported by Dr. Flint, where an apparent cure occurred in one and great improvement in the other, tincture of aconite was given for a long time. In the most successful case one minim of the tincture was given three times a day for three years; and in the other it was given in increasing doses up to seven minims, and continued ten months. In one case in my experience, not far advanced, and where the patient appeared in good general health so far as nutrition was concerned, the symptoms disappeared under the use of iodide and bromide of potassium combined. The young man whose eye was ulcerated, and who came under my observation in the Michigan University Hospital, in the most extreme condition of the disease, emaciated and anæmic, with a pulse ranging from 130 to 150, with a large and prominent goitre, and with great restlessness, nervousness, and debility, after the removal of the ruined eye, was put upon digitalis in moderate but increasing doses until its physiological effects were observed. A chalybeate tonic was given at the same time (elixir phos. iron,

quinine, and stryeh.), and the pulse was soon reduced to nearly the normal standard, the anæmia diminished, and his strength was much improved.

After the heart's action was thus diminished the digitalis was suspended and fluid extract of ergot was substituted, and the elixir of the phosphate of iron, quinine, and strychnine was continued. The rapid action of the heart did not return with the suspension of the digitalis, the enlarged thyroid materially diminished, and also the prominence of the remaining eye. After several weeks he left the hospital very much improved, though by no means cured, and no full subsequent history has been obtained. In other cases within my experience, under some variety of treatment as suggested by particular conditions, improvement has been produced; but most of the cases have come to me from a distance, and have not been a sufficient length of time under observation for ultimate results to be ascertained.

All concomitant morbid conditions should of course receive attention, and hygienic measures should not be neglected. Other remedies than those mentioned have been advised, and among them hydropathy and galvanization. Rational indications should be followed, and a persevering course of management will be required.

AORTIC ANEURISM.

The general subject of aneurism more particularly belongs to the department of surgery, but thoracic and abdominal aneurisms come under the care of the physician, and their discussion naturally follows that of diseases of the heart.

The common cause of spontaneous aneurisms has been considered to be an atheromatous condition of the inner coats of the arteries, generally commencing in an inflammatory process called by Virchow a chronic endarteritis, resulting in degenerative changes, and at length in deposits of fatty and calcareous matters, often mingled with cholesterolin.

As the result of these deposits an ulcerative process occurs, and the inner coats of the artery in patches are destroyed. The external fibrous coat remaining, but unsupported by the inner coats, yields to the pressure of the blood, and thus a false aneurism is produced. When all the coats are destroyed and a sac is formed by the surrounding tissue, it is called a true aneurism. Aneurisms are called *cylindrical*, *fusiform*, and *saciform*, according to their shape. They are said to be *cirroid* when several bulgings occur in different directions, giving an irregular scolloped form to the vessel. Recent inves-

tigations have rendered it probable that spontaneous aneurisms have been too exclusively attributed to atheroma. Other degenerative changes may take place in the arterial coats. It is believed by Kennedy* that fatty degeneration of the arteries is frequent, and it is now generally held that the most frequent cause of sacculated aneurism is to be found in changes of the muscular coat of arteries, by which its fibres are weakened and finally ruptured and destroyed, the weakening being the result of chronic inflammation or of fatty and other slow changes. That some aneurisms, however, particularly the more diffused and cylindrical, are caused by atheroma, cannot be questioned. These aneurisms are rare in young persons, though they are not confined to advanced life, and are sometimes the result of syphilitic disease.

When there is disease of the artery, rendering it less firm, any unusual exertion which increases the blood pressure will be the immediate cause of the rupture.

Aneurisms may occur in any portion of the thoracic aorta, but are much more frequent in the ascending portion or at the arch, as Gibson's well-known statistics show. They sometimes occur at the sinuses of Valsalva, and may make their way into the cavities of the heart. Two thirds of those affecting alone either the ascending, the transverse, or the descending aorta, are sacculated, while those affecting both the ascending and transverse portions are cylindrical or fusiform. The direction most frequently taken by the aneurisms of the ascending aorta is to the right; of those of the transverse portion about one half are directed toward the back, and the other half toward the right and front.

Diagnostic Symptoms and Signs.—The phenomena of aneurisms of the aorta, by which they are distinguished, may be divided into two groups: rational symptoms and physical signs.

The only condition which is positively characteristic of a thoracic aneurism is a *pulsating mass other than the heart, beating quite or nearly synchronously with it, and with at least as much apparent force, and expanding with each beat in every direction*. Its pulsations are usually accompanied with *bruit*, blowing, whizzing, or other sounds, produced by the blood passing into and out of the sac, or through the irregular calibre of the vessel. These more positive signs are not always discoverable, and a variety of symptoms and less conclusive signs must be depended upon in determining the diagnosis.

Pain, as a rule, is the earliest symptom. It varies in severity, in constancy, and continuance. It may be confined to the region of the

* Fatty Disease of the Heart.

aneurism, or may radiate to the neck and arms, or extend along the sternum or the spine. It is more lancinating and continues longer than the pain of angina pectoris, but is not as agonizing and depressing, and does not give the same sense of dissolution. When it is near the heart and is fixed, it is very strongly indicative of the early stage or commencement of aneurism. A pain of a similar character may arise from other causes, and cannot be depended upon.

After the aneurism has continued for some time the pain may disappear, or occur only at considerable intervals.

Most of the symptoms depend upon pressure of the tumor upon adjacent organs and nerves. These symptoms are various. The most common is *dyspnœa*. The pressure producing this symptom may be upon the trachea, the bronchi, the lung substance, or the respiratory nerves. When it is upon the trachea, the passage of air to both lungs will be obstructed. When upon a main bronchus, to one lung; and when upon smaller branches or the lung substance, the obstruction will be more limited. Diminished quantity of air in a lung causes a higher pitch of the percussion note, and a more tympanitic sound. With this there may be the unusual combination of bronchial respiration. By pressure upon the recurrent laryngeal nerve the voice may be affected and its character altered, or it may be entirely suppressed.

Cough is another symptom. This may be produced by direct pressure upon the bronchi or lung, or upon the pneumogastric or laryngeal nerves. When the pressure is upon the nerves, the cough is of a loud barking, or metallic ringing character, with very little mucous expectoration. When the pressure is upon the lung, more expectoration is likely to be induced, resembling a phthisical state; in "weeping" aneurism it is apt to be bloody.

Hæmoptysis may occur in specks and streaks from injury by pressure upon the lungs, or of a profuse and fatal character from rupture of the aneurismal sac, and discharge of blood into the air-passages.

Dysphagia may occur from pressure of the aneurism upon the œsophagus, or perhaps upon the pneumogastric nerve.

Pressure on the subclavian artery may affect the radial pulse on one side; or, if on the veins, may cause œdema, and when upon the vena cava there is apt to be enlargement of the superficial veins. There is sometimes an œdematous collar with enlarged veins around the root of the neck.

Pressure on the heart may cause its displacement, and may embarrass its movements.

Pressure upon spinal nerves and the sympathetic produces various symptoms. Among them are contraction of the pupil of the affected

side, and in some cases, where the nerves are irritated, dilatation of the pupil.

The *physical signs* will greatly aid the diagnosis in most cases, and in many instances are alone conclusive of the disease.

On inspection, a pulsating tumor may or may not be seen. In some cases, not only the soft but the bony walls of the chest yield to the projecting tumor, and it presents itself under the skin, which reddens or becomes purple as an external rupture is threatened.

The most frequent positions of the bulging are the right infraclavicular region, close to the sternum, the left infraclavicular and mammary regions, the upper sternal and infraclavicular regions on both sides; and in one case which came within my observation the tumor presented itself in the right lower mammary region, some distance below the nipple. This case was seen during its progress and at the autopsy. A large sacculated pear-shaped tumor extended from the ascending aorta near the arch, and, pressing the lung away and causing absorption of the ribs, presented a livid projection the size of a man's fist in the region mentioned.

It was nearly filled with quite firm coagula, and a large opening in the sac was found where the tumor came in contact with the right bronchus; but this opening was so obstructed by the partially organized coagula that only serum escaped, slightly tinged with red corpuscles, which largely occupied the pleural cavity.

On percussion there will be dullness or flatness over the seat of the tumor when it approaches the walls of the chest. This often gives the earliest indication of the enlargement, and where the symptoms create a suspicion of the disease, the percussion should be carefully and extensively made. When deep beneath the sternum, and covered with lung, an aneurism of considerable size may not be detectable by this sign.

Auscultation is among the more important means of distinguishing thoracic aneurisms. The tumor may, however, produce no sounds at all.

Silence is not uncommon in sacculated aneurisms of the arch. There may, however, be a double sound, or a thudding, throbbing noise; or a double *murmur*—the sound produced by the blood passing in and out of the sac; or there may be a *systolic murmur* with a diastolic sound; or a diastolic murmur with a systolic throbbing sound. These different sounds are not so exclusively dependent upon special anatomical conditions as to be of practical importance in distinguishing with positiveness special states.

The exact location of an aneurism must be made out by a careful examination of the parts affected, by considering the pressure as well

as the place of dullness and the seat of sounds ; and also by considering all the other conditions of the case,—the pulses in different parts, etc.

The secondary conditions of the heart must be noticed with care—its displacements, obstructions, sounds, impulses, and size ; and the results upon distant parts must also receive attention.

The Pulmonary Signs must be particularly looked to, especially over the large bronchi, in the interscapular space. Stridulous breathing and bronchial respiration are often heard, and generally in a large aneurism there may be abolition of the respiratory murmur over a space, and sometimes everywhere except at the base of the lungs.

It is proper to mention that aneurisms of the aorta have been found *post mortem* where no symptoms had indicated any disease in the chest, and where no physical signs had been discovered.

The prognosis of thoracic aneurism is always grave, and there is more or less danger, in different cases, of speedy death, especially from rupture and hemorrhage, and sometimes from pressure on important parts.

The *course*, however, is generally *chronic*. The patient may be worn out by increasing marasmus, by the slow effects of pressure, by “weeping,” which may last some time, and finally by rupture, the blood flowing into the air-passages, the alimentary track, the pleural cavity, or externally.

TREATMENT OF AORTIC ANEURISM.

Aneurisms of various arteries, including those of the aorta, are sometimes spontaneously cured ; and this gives encouragement to treatment. The natural modes are, (1) by sphacelus of the tumor—the arterial opening remaining closed ; (2) by obstruction of the artery, and (3) by filling of the tumor with fibrinous clots, the artery remaining pervious. The first is rare, and not to be imitated. The second is imitated by the surgeon in ligating or compressing arteries, but is obviously not applicable to aneurism of the aorta ; but the third may sometimes be imitated medically.

Various methods for inducing coagulation and cure have been suggested and practiced. One is by the introduction of numerous fine iron wires through the sac to afford many points of coagulation. Its success has not been sufficient to encourage further attempts in its use.

Another method is by electrolysis. It is applicable only to sacculated aneurisms, and these are not always distinguishable from the more diffused. As a dernier ressort it may be tried. Fine needles are

to be introduced into the sac, and a continued current employed. Success by this method has not been sufficient to give confidence in its efficacy, or even to render it justifiable until other means have failed.

Hypodermic injections of ergotin have been used for accomplishing the same purpose. Favorable cases have been reported, but not in sufficient numbers to give much confidence in its value.

Valsalva's method has long been in use. It consists in bleeding, purging, a low diet, and rest, with the view of reducing the current of blood to a point where coagulation will take place. This has sometimes been successful, but it is attended by consequences which may not only be permanently injurious, but more immediately dangerous. It is at the present time seldom practiced, though a modification of it—omitting the bleeding, but insisting upon positive rest in the recumbent posture, with a diet of but two ounces of liquid and four of solid food, morning and evening, and four ounces of liquid and six of solid at midday, and the frequent administration of laxatives—is said to have been attended with very satisfactory results. In order to be successful it must be steadily and perseveringly carried out until the coagulation is effected and the pulsation arrested. Twenty-one to thirty-seven days are said to have sufficed in some cases, but the treatment should be continued from eight to thirteen weeks before it should be considered a failure. To the rest and low diet arterial sedatives are sometimes added—the *veratrum viride* in doses sufficient to reduce the pulse to fifty per minute.

The latest, and what is alleged by high authority to be by far the most efficient, treatment consists in the free administration of iodide of potassium. The testimony as to the wonderful effects of this article in relieving the pain and other symptoms, and diminishing the size of aortal aneurism, has accumulated to such an extent as to leave no doubt of its striking utility in many cases, and to require its administration.

Dr. Balfour* gives an account of the introduction and use of this article, and of a large number of cases treated by it. He says: "It relieves the pain and other symptoms of aneurism more rapidly and more effectually than any other treatment, apart even from the powerful agency of the recumbent posture, and for the time it has been in use it has given greater and more permanent relief to a larger number of cases of aneurism than any other mode whatever. Indeed the relief to the pain and other symptoms is so great and so speedily obtained, usually from the drug alone, that it is often difficult to get the

* Clinical Lectures on Diseases of the Heart and Aorta.

patient to submit to any restrictions. Besides it is not always necessary."

If the effect of the iodide is to produce coagulation or to diminish the blood pressure and its effects, rest and a moderate diet will aid the process, and the author quoted advises the rest particularly, as an important adjuvant.

It seems to have marked effects independent of any action in causing coagulation, as it gives speedy relief to the pain when given in free doses, and indeed *post-mortem* examinations have shown that coagulation had not taken place where, nevertheless, very great relief had been given by the iodide.

The ordinary dose recommended is twenty grains three times a day in a bitter infusion, though as many as forty-five grains have been given at a dose, repeated thrice a day, with success. These doses are generally well borne. If irritation, coryza, eruptions, etc., are produced the medicine may be stopped, but as these effects subside it may be resumed in full doses.

Although more or less relief is speedy, the medicine must be continued a long time to produce its full effects. Complete cures are exceptional, but very great relief for indefinite periods is produced by the continued use of the drug. Wasting of normal tissues, once so much feared from preparations of iodine, seems very seldom to take place from the large doses. Roberts, Bouillaud, Flint, and many others, have borne testimony to the remarkable results of this remedy. The venerable Dr. Walsh, of London, expressed to me recently, in enthusiastic terms, the great benefit he had derived, even in far advanced cases, from large and long-continued doses of this medicine. When asked how he accounted for its effects and the mode of its operation, he said he did not account for the effects, nor know the mode of its producing them.

Barium is another remedy which has recently been recommended. "From ʒss to ʒj of the liquor barii chloridi, well diluted, may be given three times a day after meals." (Bartholow.)

Proper hygienic management, the avoidance of active exertion, abstinence from alcohol, which article in any form Balfour regards as injurious, and the proper treatment of any concomitant morbid condition, will be required.

Aneurisms of the coronary artery have occurred, but they are rare and have no defined clinical history. They vary in size from that of a pea to that of a walnut, and usually rupture into the pericardium.

ANEURISM OF THE ABDOMINAL AORTA.

The abdominal portion of the aorta is subject to aneurism in any part of its course, but aneurisms are more common near its passage through the diaphragm. But few cases occur below the origin of the renal arteries.

Aneurisms here are produced by the same causes as those in the thorax, and are attended by some of the same symptoms. The symptoms from pressure will be different, as the parts pressed upon are different.

The tumor may spring from the anterior or posterior part of the aorta, and when from the posterior part, there will be a less prominent tumor but more pressure upon deep parts. It is often in a situation to involve the branches of the aorta, and may press upon various nerves, giving rise often to severe pains. The size of the tumor varies greatly, some being small, while others are of immense size. One case coming under my observation caused much distention of the abdomen, displacing the intestines and pressing upon the liver and stomach; and as the tumor was filled with coagula and presented no pulsation or *bruit* at the time the case was presented, the diagnosis was obscure. There was a history of an enlargement suddenly coming on with very intense pain, and on post-mortem examination, as reported by the physician making it, some two years after the case came to my clinic, and some four years after the attack, a very large aneurismal sac was found, filled with layers of fibrine solidified and partly organized.

Symptoms.—The symptoms of abdominal aneurism are pain, sometimes continued but often paroxysmal, and generally severe, though cases have occurred where the pain was not sufficient to attract attention. The continued pains are wearisome and deprive the patient of rest, the paroxysms are agonizing, and often leave the patient prostrated after each attack. In the case referred to, the suffering was so great that morphine seemed a necessity, and the habit of taking large doses was established. The pain may radiate in different directions, and it varies in character and intensity.

A pulsating tumor is usually readily perceived. There is a heaving, expanding impulse, and a jarring thrill, as in other aneurisms.

A *bellows murmur* is generally heard, as in aneurisms of the thoracic artery, and need not here be described.

The *pressure signs* are such as can readily be understood, but vary with the direction of the tumor, its size, and the parts pressed upon.

There is generally an absence of arterial and feverish excitement;

œdema and enlargement of the superficial veins are rare, and ascites still more rare; there is very little mobility of the tumor; there is emaciation and debility in protracted cases, but not the cachexia of cancer or tubercle; and the tumor does not begin below and increase upward, as an ovarian enlargement.

There are several conditions which more or less simulate abdominal aneurism, and from which it should be distinguished. Simple increased aortic pulsation may be mistaken for aneurism. In this a distinct tumor cannot be felt, and the impulse is not so expansile. It is said a murmur is very rarely present, scarcely ever diastolic, and never heard over the spine. At this present writing, three cases are under my care, all in men, all in connection with some dyspeptic trouble, where no tumor can be felt, no severe or characteristic pain usually marking aneurism has been experienced, but where a very distinct, and in two of the cases a loud blowing murmur is heard at the epigastrium, but not much lower, and where a strong pulsation is felt.

In these cases of irritable and pulsating aorta, pressure with the stethoscope may produce a murmur, and in examination this should be guarded against. In some cases of this kind where the blowing sound proceeds from a point near the diaphragm, it may be impossible to come to a decided opinion.

A tumor not aneurismal or itself pulsating, by lying upon the aorta may receive its impulse so as to resemble an aneurism, and it may present the blowing murmur. Such tumor is usually movable, and when grasped and elevated the impulse ceases or is diminished, and it is never expansile.

Some tumors which are vascular, such as soft cancer, pulsate independently of the aorta, with a heaving, expansive impulse which is difficult to distinguish from an aneurism. But in such cases other evidences of cancer—the rapid pulse, hot skin, and the cancerous cachexia—will aid the diagnosis. The thrill and *bruit* will, however, not be as marked as in aneurism, and the history of the case will soon reveal its nature.

Again, a pulseless tumor may resemble a non-pulsating aneurism. The absence of murmur, and the evidences of other disease will usually lead to a correct diagnosis. Some cases, however, are obscure, and time may be required to clear them up.

Severe pains without a discoverable tumor may resemble those of aneurism, and should lead to a careful investigation. Where physical evidence of an aneurism cannot be discovered, and the whole symptoms are not sufficient to point out some other disease, the case must remain obscure.

The *course*, *duration*, and *termination* of abdominal aneurism

will not differ materially from those of thoracic aneurisms, and need not be repeated.

The *treatment* of abdominal aneurism will be similar to that of thoracic. One additional remedy not applicable to thoracic aneurism has been used in abdominal, viz., compression. Where iodide of potassium and other means fail, this may be tried; but as it is a surgical procedure the reader is referred to works on that subject for details, successes, and failures.

Epigastric pulsation depending upon irritability of the abdominal aorta is a local neurosis, not always, though often, produced by dyspepsia. As has been already stated, there is danger of its being confounded with aneurism.

In such cases the stomach should receive attention; when there is anæmia, that should be relieved, and a condition of nervous irritability should if possible be quieted.

Full doses of bromide of potassium in some bitter infusion will procure marked relief, and in many cases will be sufficient to effect a cure.

DISEASES OF THE KIDNEYS,

AND URINARY AFFECTIONS.

A distinction is properly made between diseases of the kidneys and urinary diseases, since only a part of the morbid states of the urine depends upon disease of the kidneys.

A brief account of the urine and its changes will first be given, mention of the chief causes of such changes will be made, some of their pathological indications will be noticed, and afterward the special diseases of the kidneys will be considered.

The importance of this general subject will be better understood by considering the relations of the urine to various diseases besides those of the kidneys, and of diseases of the kidneys to other diseases; and the large number of special works on these diseases, which have appeared within the last few years, is evidence of the manner in which they are regarded by the profession.

Urinary diseases are divided between the physician and the surgeon. The urinary diseases belonging to the physician are in general those in which the *secretion* is in fault, either as to quantity or quality, while to the surgeon belong exclusively those mechanical difficulties pertaining to its excretion—to its discharge from the bladder.

Physiological and Pathological Observations.—While some of the morbid conditions of the urine are dependent upon diseases of the kidney, others, as just stated, are not.

This renders it important that *diseases of the urine* should be recognized aside from kidney affections; and the chief interest of the diseases of the kidneys is derived from the importance of their function in separating effete matters from the system which appear in the urine. Some of the diseases are of importance from their sympathetic effects upon the system, but most of the general effects arise from dependence of function.

It is the case with the kidneys, much more than with most other secreting organs, that they merely separate from the blood ingredients already fully formed there, and seldom, if at all, elaborate new substances, or make new chemical or vital combinations within their vessels or tissues.

In the secretion of healthy urine two conditions are concerned, and are necessary for it, viz., a certain state of the blood and a certain state of the kidneys. Abnormal conditions of either one of these parts, while the other remains normal, may give rise to morbid states of the urine.

Derangements of nutrition, of respiration, of the secretions of other organs, and of the circulation of the blood, by causing abnormalities in its qualities or supply, produce derangements of the *secretions* of the kidneys when these organs themselves are healthy.

In order to have a sufficient quantity of urine separated from the blood, there must be a ready absorption of water from the stomach and intestines, a free passage through the portal vessels, the hepatic veins, and the capillary vessels which connect them, and there must be a free passage into and through the vena cava—through the right side of the heart, through the lungs, through the left side of the heart, through the aorta and renal arteries, and finally through the kidneys themselves; and if fluids from the stomach and intestines are not freely absorbed, or if obstruction to the circulation exists in any part of the course traced, the amount of urine, especially its watery part upon which the quantity chiefly depends, will be less.

The obstruction may be mechanical, or it may depend upon defects of some of those physiological actions which are necessary to the normal course of the fluids and the blood.

In nausea and vomiting, in obstructions high up in the intestinal canal, or in diarrhoea, where the fluids pass rapidly through the alimentary tube, absorption is less than normal, and the urine is scanty;

and if there be rapid intestinal effusion, as in cholera, the urine is more scanty still, or quite suppressed.

Indurations or contractions of the liver, obstructions in the heart, the lungs, or in the arteries, will tend to the production of the same result. Profuse perspiration will also diminish the secretion of the kidneys, and inflammation of external serous surfaces resulting in effusions will produce the same effects; and these effects will follow these causes while the kidneys themselves are in perfect health.

Of course the quantity of fluid taken into the stomach, the dryness or moisture of the atmosphere, the *climate* and *season* as to heat and cold, clothing and exposure, and even mental conditions, all may vary the quantity of urine, without producing disease of the kidneys.

Various medicines also influence the secretions, and some particular kinds of food as well.

But diseases of the kidneys themselves will vary the secretions, sometimes diminishing and sometimes increasing the quantity of urine.

In diseases which interfere with capillary circulation of the kidneys, as well as of other parts, the urine is scanty. This is usually the case in fevers, inflammations, etc.

The Malpighian bodies, it is generally conceded, secrete the watery parts of the urine, holding in solution some inorganic salts, while the tubes eliminate the solid organic elements of the urine; and as the one or the other acts more freely, we have the urine changed from the natural state in the proportion of its watery and solid constituents. We may have an abundance of water when the Malpighian tufts are active, though the tubes may not perform their functions as well, and the urine may be specifically light and deficient in the ingredients capable of solidification. On the other hand, the tubuli uriniferi may be active in their functions, while the Malpighian bodies are inactive, causing very scanty urine, but of high specific gravity—abounding in *solid organic constituents* though they are held in solution.

If, however, the tubes are very much thickened—so much as to obstruct the passage of fluid through them—the secretion of urine would be interfered with, and real *disorganization* of any of the tissues of the kidneys would be likely to diminish its quantity.

Changes in the quality of urine may be divided into two classes:

1st. Such as are produced by the elements of the blood natural to the urine, but in abnormal proportions; changes in the proportions of healthy ingredients; and

2d. Such as are produced by elements of the blood passing into the urine, which are not normally in it.

The urine may be changed in the proportions of its healthy ingredients, and its quality may thus be affected by the presence of too much or too little *urea*, uric acid, various normal salts, the phosphates, chlorates, etc., or by too much or too little water.

It may be changed in quality by the addition of matters usually foreign to it—by containing the results of imperfect digestion or assimilation, as sugar in diabetes; by containing materials which other organs should eliminate, such as the coloring matter of the bile in jaundice; and in these cases the cause of the morbid urine is not in the kidneys, but in the blood from which the urine is separated, the kidneys kindly taking on themselves the office of ridding the blood of abnormal products.

And, farther back than to the blood, we can trace the cause to the impaired condition of the digestion, to disease of the liver, or other organs.

But we may have morbid urine, as already stated, from disease of the kidneys themselves. In consequence of their morbid conditions, these organs may separate from healthy blood such materials as healthy kidneys do not separate. An inflamed and congested kidney often separates albumen—an article not found in healthy urine, and one which is not separated from the blood, except where either the kidney is diseased or the blood pressure is abnormally great.

Again, we may have morbid urine from abnormal substances foreign to healthy urine, produced in the kidneys or urinary passages, such as *pus*, mucus, fibrous casts, morbidly numerous epithelial scales, vibriones, etc.

In cases of abnormal urine arising from disease of the kidneys from morbid action in their secreting or separating function, we not only have the presence of some ingredients of the blood not normally in the urine, but an absence or great diminution of some ingredients normally belonging to it.

In the same case, of Bright's disease of the kidneys for instance, we have albumen, which is not in healthy urine, and a *deficiency* of *urea*.

The presence in the urine of proper blood matters separated by the kidneys, such as albumen or blood corpuscles, should be regarded as presumptive evidence of disease of these organs; and generally these matters indicate inflammatory disease, acute or chronic; and when such inflammation exists, we have usually at the same time an absence or deficiency of the natural solid constituents of the urine. Generally, then, when albumen is separated, *urea* is in diminished quantities, and this ingredient retained in the blood acts as a poison there. It depresses the nervous system, causing heaviness or stupor,

sometimes convulsions and other nervous derangements, and it often produces inflammation and other changes in various tissues.

The loss of albumen from the blood deprives that fluid of an important ingredient, reducing it to a thin and watery state, and from this various morbid conditions arise.

Blood corpuscles are not unfrequently found in the urine, passing by a process of diapedesis, or by a rupture of renal vessels, often the result of inflammation, but also of other causes.

The morbid conditions of the urine produced from disease of the kidneys, and those occurring without such disease, should be carefully distinguished from each other, as they are so different in their significance and in the treatment required.

Waste and repair, so constantly going on in the body, vary in their proportions to each other at different ages and in various physiological conditions of growth and decay, as well as under various morbid influences.

Oxidation plays an important part in these changes, and its different degrees of activity and completeness vary the conditions of the tissues, the blood, and the excretions from the blood. The composition of the urine largely depends upon this process. The effete organic matters in the system, the results of the disintegrated tissues, are prepared for elimination by oxidation, and the azotized materials which result from this disintegration, as well as azotized foods not appropriated to the building up of structures, when most completely oxidized and best prepared for elimination by the kidneys, take the form of urea. This is the most important of the normal constituents of the urine; but uric acid and the urates are also so constantly present as to be classed among normal constituents. Uric acid is the result of a lower oxidation of similar materials—of nitrogenous foods and of the metamorphosis of nitrogenous tissues. Phosphates and other materials in varying quantities are also present—all these together constituting the solid constituents of the urine.

Different substances taken into the stomach pass through the body and appear in the urine unchanged, while others undergo more or less change, but, being unfit for appropriation by the tissues, appear as waste matter in the urine. Various substances, the results of imperfect digestion, of malassimilation, and of morbid disintegration, also appear in the urine, and its conditions thus become evidences of the manner in which various processes in the system are performed.

We are to look to the secretion from the kidneys for evidence of many of the derangements in the functions of digestion and assimilation—of malnutrition and morbid disintegration.

When more food is taken, digested, and absorbed than can be appropriated, or when destructive processes are going on with much rapidity, more solid materials than can be held in solution, especially when the urine is cold, are often present, and deposits take place. Still, deposits are not always evidences of a morbid state of the urine, nor is the natural appearance of the urine, so far as the naked eye can detect, a proof of its healthy condition. Albumen, sugar, oxalate of lime, vibriones, and even casts of the uriniferous tubes, may be present without materially changing the general appearance of the secretion, and hence the necessity of microscopical and chemical examinations to determine its character and significance.

The quantity and character of perfectly physiological urine varies very much in different persons of different ages and habits, and also in the same person on different days and at different periods of the day. It is affected by temperature, moisture, exercise, meals, drinks, and a variety of other conditions which may be regarded as physiological.

The varieties of urine voided at different periods of digestion and assimilation have been arranged under separate heads.

Dr. Prout speaks of *urina sanguinis* of the older physiologists—the urine voided from the blood only—and *urina potús*—the urine voided not long after drinking and ordinary eating.

Perhaps, however, the more correct division and nomenclature would be into the urine of the blood, or that resulting from secondary assimilation only, and the urine of *assimilation*, including the urine resulting from both primary and secondary assimilation. In the one case the urine would contain, almost exclusively, effete matter, the result of disintegration; and in the other, in addition to this, various substances from the food and drink not perfectly assimilated, or perhaps not assimilable.

The specimens of urine in the morning before breakfast and in the evening after a full dinner are quite different, representing the two varieties of Dr. Prout.

Others make three varieties, namely, *Urina Chyli*, *Urina Sanguinis*, and *Urina Potús*.

The *Urina Chyli* contains some of the substances of the food that have not been assimilated; the second, the *Urina Sanguinis*, contains largely those elements of disorganization which are derived from the retrograde metamorphosis of the tissues, but also those produced from foods which have been changed in the production of force; and the last, the *Urina Potús*, that which is passed after free potations, after drinking free quantities of water or other fluids. This may be a simple dilution of the other varieties when water alone is taken. In

order that proper indications may be furnished from the urine, it must be examined at different periods of the day, or the whole quantity passed during the twenty-four hours should be saved, and a specimen taken from the whole; or the period in reference to meals and drink in which it is excreted must be taken into consideration.

The urine for the twenty-fours taken together is acid in reaction, it has usually a golden, reddish color, though it varies much from causes which may not be morbid, and still more from morbid and accidental causes. When rapid disintegration is taking place, as in fevers, or in excessive muscular action, the urine is more highly colored and its specific gravity is increased, and when large quantities of nitrogenous foods are taken a similar result is produced.

Various substances ingested give color to the urine, either by the coloring particles which they contain passing unchanged, or by combinations formed with materials met with in the system.

The morning urine—that which has been secreted after the digestive process has been completed, and assimilation of the food has taken place—will contain more largely the results of disintegration and oxidation, while that after dinner, the chief meal of the day, will contain additional ingredients.

The morning urine will be moderate in quantity, considering the length of time since any was passed, and unless *very small* in quantity from perspiration induced by warm covering, etc., it would be of moderate specific gravity, though of higher color, usually, than that passed during digestion.

In health the morning urine is comparatively uniform in quality, and any very marked deviation from that uniformity indicates either some derangement in ultimate nutrition, or a very slow process of digestion.

If the morning urine, *secreted* after digestion is completed, and some time after much fluid has been taken, be copious, transparent, and pale-colored, this continuing so for a length of time, some abnormal condition exists. If, in addition, it is of low specific gravity and serous, disease of the kidneys may be suspected.

If the morning urine be copious, transparent, pale-colored, and of high specific gravity, the existence of diabetes is denoted.

When there is a sediment in a specimen of turbid morning urine of a pale or bright pink color, an excessive quantity of food, or some affection of the digestive organs retarding and rendering incomplete the assimilating processes, is commonly indicated.

The urine voided in the evening after a full meal—or the chylous urine—is subject to much greater variations, both in quantity and quality, than the morning urine. Even with those in fair health the

evening urine may be deep-colored, above the average specific gravity, and during the winter months especially it is apt to become turbid on cooling.

The normal morning urine and the whole quantity for the twenty-four hours is acid ; that passed soon after a meal is diminished in acidity and often becomes neutral or alkaline. This may be due to the withdrawal of the elements of acids from the blood during the process of digestion, or in some cases it is due to alkalies contained in the food.

But in dyspeptics—those affected with imperfect digestion—or in those who take more food than can be fully digested, and particularly in a damp, cold, and chilly state of the atmosphere, and when the skin is inactive from want of exercise or other causes, great deviations in the evening urine occur. It often partakes of the odor of the food, especially when substances have been taken which have marked odorous qualities, such as onions, some fruits, and other substances containing volatile oils.

Very pale urine may arise from quantities of water taken, from hysteria, or from some chronic disease ; while very highly colored urine is generally the result of some acute affection.

The quantity of urine passed in the twenty-four hours, as well as that passed at different periods of the day, varies very much in different persons and from a variety of circumstances. The amount and quality of food and drink, the profuseness or scantiness of watery discharges from other excretories—the skin, the bowels, and the salivary glands—the amount of exercise, the temperature and moisture of the atmosphere, and various mental states, exert an influence upon the amount as well as the quality of the secretion, and no positive statement of the normal quantity can be made.

As the result of observations of my own and others, the average amount passed in this country is below that given by English observers. This is due partly to the comparative dryness of our climate, but possibly still more to the habits of our people. Our food is perhaps less watery, and our potations are less. Parks gives an average of fifty-two ounces, or three and one half pints ; Thudichum, forty-seven and one half ounces ; Valentin and Lehmann somewhat less ; and in this country from two and one half to three pints would quite equal, if it does not exceed, the average amount.

The urine, composed of various substances, solid and liquid, is strictly excrementitious, and an undue retention of any of its ingredients produces derangement in the system.

In various morbid conditions of the kidneys themselves, and in

obstruction of the circulation of the blood and from other causes, the functions of the kidneys are interfered with, various constituents of the urine are retained in the system and various morbid results follow.

When the amount of water secreted is greatly diminished, or entirely suspended, a large proportion, or all the constituents of the secretion are retained in the blood, and injurious effects are produced.

Urea is the most abundant of the solid constituents, and its retention is productive of the most serious consequences. The retention of water may result in dropsical effusions and other injurious effects; but as urea and other materials are retained at the same time, it is not easy to determine what is due to the retention of water alone.

Complete suppression of urine, or anuria, though rare, sometimes occurs. It not very unfrequently takes place in cholera, as was mentioned when that disease was described, and it may arise from other causes. Partial suppression or markedly diminished secretion is a frequent occurrence.

Complete suppression may arise from severe disease of the kidney, inflammatory or other degenerations—in scarlatina, in cholera, in yellow, and rarely in other fevers. It may be the result of obstruction of the ureters, or of retention within the bladder, the urine in these cases mechanically pressing upon the kidney and preventing its further secretion. Partial suppression is the result of a variety of conditions, chiefly of special diseases of the kidney, which will be referred to when those diseases are described. The kidneys fail to perform their full secreting function in many fevers, in diseases of the heart and brain and other organs, when a train of phenomena or pathological states, chiefly attributable to retention of *urea*, is produced, which is called *uræmia*, or uræmic poisoning. As this occurs most frequently in Bright's disease, acute or chronic, it will be more fully described in connection with that affection. In this disease, however, there is protracted loss of albumen and other morbid changes, and all the symptoms are not attributable to retention of urea. It may, however, be proper to say that uræmia appears in an acute and chronic form, according to the completeness of the retention and the suddenness of its occurrence.

The first and mildest effects of an acute attack are confusion of ideas, failure of memory, unusual sluggishness, and general *malaise*, and then will come on a more distinctly *drowsy* condition. This deepens into sopor and resembles strikingly the effects of a large dose of opium—the patient can be aroused to consciousness, but soon again falls asleep; and this sleep passes into stupor and true coma, and if the urea be not removed, suspension of respiration and death follow, either with or without convulsions.

In some cases convulsions of an epileptic form may be the sole or chief manifestation—there being little or no sopor, and consciousness not being destroyed until the full convulsive state occurs. This state is as unpromising as the others, and death will often follow unless the urea be speedily removed. These, or a modification of these convulsions, occur in puerperal cases; constituting the uræmic eclampsia of *Braun*. These puerperal convulsions are perhaps not as generally fatal as those which occur under some other circumstances, as delivery may effect a change in the action of the kidneys, and the consequent elimination of the poison.

But among the first symptoms of the more gradual cases of uræmic poisoning is œdema in various parts of the body, accompanied with lowness of spirits and a melancholic expression of countenance, with restlessness, dizziness, headache, fretfulness, partial anæsthesia, and sometimes delirium. Nausea, retching, or full vomiting are often present. There may be rigors, *muscæ volitantes*, and more or less impaired vision.

When in uræmia, in any of its forms, stupor and coma finally supervene, a greater or less degree of apoplectic *stertor* accompanies the respiration, and the stertor has a peculiar *high tone*, distinguishing it from common apoplectic snoring; there is more spasm, and less of simple paralysis of the muscles concerned.

The action of the poison in these cases of sopor, coma, and especially in convulsions, is early directed to the spinal marrow, hence the sensitiveness to motor impressions, convulsions, etc.; but the brain is also very early involved, though not so markedly in its intellectual portion.

The course of uræmic poisoning will be various, depending upon the amount of the poison and the rapidity with which it accumulates.

In cases of Asiatic cholera, where the suppression of urine is complete, within twenty-four or forty-eight hours after the purging ceases symptoms of uræmic poisoning set in, and if the secretion is not restored, or purging is not instituted, the full phenomena of fatal poisoning rapidly supervene, and death occurs after not many hours. I have seen many such cases.

When the poison is slowly introduced by a more gradual and partial disease of the kidneys, as is the case with other poisons, the system becomes accustomed to its effects, and a degree of tolerance is established.

Whether the poisoning in these cases is produced chiefly or to any large extent by the urea of itself, or by the carbonate of ammonia into which it is readily converted, or by some other material still, is not fully determined. It is probable that several substances operate in pro-

ducing the injurious effects which are observed in suppression of urine, and they may produce their effects in different ways. These materials, whatever they are, often enhance the reflex functions, so that a moderate peripheral irritation of the stomach, intestines, uterus, and other parts, will produce convulsive and various other morbid phenomena.

Pathology.—No very marked structural changes result from uræmic poisoning. An anæmic and watery condition of the brain has frequently been observed, but mostly in cases where a general dropsical condition was present; and it is by no means certain that this was the result of the poison or the cause of the symptoms.

Cerebral hemorrhage is sometimes found, but is probably caused by the violence of the convulsions.

The lungs are often œdematous, but this may be due, in part at least, to other causes than the presence of urea.

After relating the numerous observations and experiments which have been made to elucidate the special pathology of uræmia, and after discussing the numerous theories which have been put forth on the subject, Bartels* says, "I only consider this much established, that the symptoms are all caused by some disorder of the urinary secretion, and that the title of uræmia is rightly attached to them."

The retention of uric acid by imperfect action of the kidneys produces other effects of a morbid character.

Whether from excessive production or deficient elimination, or from both, the presence in the system of an abnormal quantity of uric acid, either free or in the form of urates, is regarded as the chief element in the production of gout, and various other symptoms are doubtless due to the same cause.

When deposits in tissues take place, producing gouty inflammation, they are in the form of acid urate of soda. This subject was referred to when gout was described. Such deposits are sometimes abundant in various parts, particularly in the articular surfaces of joints, in the cartilage of the ears, and in the substance of the kidneys. In such patients, urates are generally found deposited in the urine and not unfrequently free uric acid as well.

Urates are sometimes found deposited in the urine of comparatively healthy persons, and in such cases the deposit may depend upon a deficiency of water in the system, so that a sufficient quantity is not found in the urine to hold the salts in solution, and the indication is to drink more water. Uric acid alone or in combination is sometimes deposited in the pelvis of the kidneys, in the bladder or ureters, forming urinary calculi. In the bladder they come within the province of

* Ziemssen's Cyclopædia.

the surgeon, and the whole subject of these and other forms of urinary calculi is treated of in works on surgery. They will therefore not occupy further attention here.

Uric acid, then, may abound in the system from its too free production caused by taking too much nitrogenized food, from rapid waste of tissues as in fevers, or from deficient oxidation of the respiratory or circulatory system, etc., from morbid conditions of the liver, or from deficient elimination by the kidneys.

Treatment.—When free uric acid prevails, the alkalies—potash and soda—are indicated, as at least palliative measures. When urates abound, dependent upon deficient oxidation in the system, means should be resorted to for the purpose of removing the obstruction to oxidation in the lungs or elsewhere, free ventilation, exercise in the open air should be required, and oxidizing agents, such as the nitrohydrochloric acid, chlorate of potash, and various tonics, are indicated.

When this condition is produced by the other causes named—errors of diet, etc.,—these should be corrected.

When the uric acid or urates are in excess in the system from deficient elimination from the kidneys, the phosphate of soda, the carbonate of potash, and various diuretics, vegetable and mineral, are called for. Colchicum is thought to be particularly efficacious in the elimination of these materials.

The effects of accumulation of other materials in the system, physiologically eliminated by the kidneys, either from their increased production or their diminished elimination, are less understood than those which have been mentioned. Kreatine, kreatinine, uræmatine, hippuric acid, chlorine, phosphorus, sulphuric acid, ammonia, and their compounds, xanthia, hypoxanthia, and gummi are, however, doubtless retained with injurious effects.

The presence of oxalic acid and its compound, oxalate of lime, has been mentioned in another connection. The appearance of oxalate of lime for a considerable time in the urine is indicative of this material in the system—of malassimilation, and especially of deficient oxidation—and requires remedies which will improve digestion and oxidation.

The presence of phosphates in the urine in unusual amounts has its indications which are worthy of attention. The deposition of these substances depends upon the reaction of the urine quite as much as upon the amount excreted. The deposit of ammonia-magnesium phosphate in the urinary passages is generally due to some local cause which induces retention and decomposing changes.

The phosphate of calcium and magnesium, when deposited in fresh urine, indicates an excess of alkalinity, or of earthy phosphates

themselves, and is produced either by a low state of vitality or an excess of alkalies in the ingesta. Acids in these cases are indicated, and both the mineral and organic are generally useful.

A deficiency of phosphates in the urine may indicate an excess in the system, especially when there is functional activity of the nervous system which favors the production of the phosphates, and this condition may indicate eliminatives as in other cases of retained materials.

Increased eliminative functions of the kidneys may result in a drain from the system of elements needed for its uses.

The passage of an abnormally increased quantity of water has been considered in describing the rare affection diabetes insipidus.

Without the production of this distinctive affection, the quantity of urine is often unusually increased, constituting *diuresis*. This may be produced by drinking a large amount of fluid, or by cold and dampness checking elimination from the skin. In such cases the increased amount of the kidneys' secretion cannot be regarded as pathological in its effects, but as simply ridding the system of a superabundance of fluid.

The urine is increased by various articles taken into the system, which have a tendency to pass off by the kidneys, exciting them to an increase of their secreting function. The various diuretic medicines are illustrative. Some articles of food, such as asparagus, water-melons, different fruits, etc., have that effect.

Various mental states, as fear, nervous agitation, hysteria; and sympathetic excitements from different impressions upon other organs may increase the secretion of the kidneys.

A moderate degree of irritation of these organs, from whatever cause, increases their functional activity, and a hypertrophied condition increases their secreting power.

Excepting when diuresis arises from large quantities of fluid ingested, or from diminished loss from other secreting organs, it may be injurious, depriving the system of its proper amount of fluid and thus interfering with its most normal actions. This would excite thirst and induce free drinking, which would be the natural remedy; but the fluid passing rapidly and freely through the system is apt to wash away other ingredients from the blood prematurely—carrying nutrient materials off, not allowing time for their proper appropriation. By these means, as well as by the sedative action of an excess of water upon the tissues, debility and exhaustion may be induced.

Still, simple diuresis seldom produces serious effects. It is, indeed, often therapeutical, removing dropsical accumulations, and various effete or injurious materials from the system.

When an increased quantity of urea appears in the urine, it is an evidence of an increased production of this material in the system, from food or tissues; and although this may be the result of a morbid process, its elimination by the kidneys is not morbid. It is rather beneficial.

Urea is increased in fevers, inflammations, and most acute diseases, but the more active the kidneys in carrying it off, the better for the patient.

These remarks respecting urea will apply with equal force to uric acid and the urates, and, in fact, to all the other natural ingredients of the urine which are excrementitious and are physiologically eliminated by the kidneys. The more complete their elimination the better.

When the urine contains a superabundance of normal solid constituents, the free drinking of water is indicated to prevent deposits in the urinary organs. The free use of water increases elimination by all the emunctories, and it is generally indicated where effete matters are retained.

The coloring matter of the urine requires a word in these general statements of some of the more important matters respecting this secretion.

There are several distinctly characterized bodies in normal urine which give it color. Those which have been isolated and most distinctly recognized are called *urobiline* and *indican*. Urochrome, urohæmatin, and uroxanthin are other names applied to less definite compounds which aid in giving color to the urine.

Urobiline is a derivative from worn-out and metamorphosed blood corpuscles, and when increased in the urine is an evidence of an increase in the destructive change of this important element of the blood.

In fevers, in inflammation, and in all diseases inducing anæmic states, while the active process is going on the urine contains a larger amount of this substance than in health, and it is more highly colored.

Indican appears to be more the result of the metamorphosis of tissues and of albuminous foods. It is more abundant in wasting diseases, and when an exclusive flesh diet is taken; and it is enormously increased when there is obstruction and closure of the small intestines. It is also increased in cancer of the stomach, and in peritonitis. There is an increase of this material in consumption when emaciation is progressing; and certain drugs, as turpentine, nuxvomica, oil of bitter almonds, etc., are said to increase it. Fevers increase more the urobiline than the uroindican, as there seems

then to be more rapid destruction of the blood corpuscles than of the tissues. The tests for these different coloring matters are described in the special works on analysis of the urine, the details of which are not within the scope of this work.

The color of even normal urine varies with the amount of exercise, the amount and kind of food, but more by the amount of water secreted; and in various morbid conditions the color is greatly varied.

Some specimens are almost colorless, especially in hysteria and some other neuroses. In diuresis or hydruria, and in diabetes it is pale, though the yellowish tint is perceptible, and whenever the amount of water is great, the coloring matter, though normal in amount, is diluted so that the color is lighter. In many cases an increase of water and a deficiency of coloring matter concur in making the urine pale.

Highly colored urine occurs in fevers and inflammations, dependent chiefly upon the increased destructive changes going on, and often upon the diminished quantity of water secreted.

In granular kidney with the normal amount of water, the amount of coloring matter is greatly diminished and the urine is pale.

But various coloring matters not normal to the urine are sometimes found in it, modifying its color. *Blood-red or garnet-red urine* is caused by some such foreign matters. Blood in the urine is perhaps the most frequent cause of this color, though a number of vegetable matters, excreted through the kidneys, impart to alkaline urine a red color.

Dark brown or nearly black urine is sometimes seen, and is caused sometimes by methæmoglobin from diseases of the kidney, especially where a hemorrhagic state exists; and a similar color may be produced by the passage of biliary coloring matter through the kidneys, and by other coloring matters as yet imperfectly known. After the external use of carbolic acid, as from Lister's dressing, the urine is sometimes found of a dark color.

A dirty green color of the urine is often produced by jaundice, the coloring matter being biliverdin, and having the same significance as some of the cases of dark brown urine.

A dirty blue urine is sometimes seen, generally in connection with a dark blue skin. It has been observed in some cases of cholera and typhus.

The normal *odor* of urine it is unnecessary to describe, but abnormal odors are often observed and require notice. Whenever the urine becomes alkaline from standing, or decomposing changes take place from its retention, an ammoniacal odor is perceived. When destruc-

tive changes occur in the bladder, very foul odor of the urine is apt to occur. By the use of certain foods and medicines, the odor of the urine is strikingly changed. Asparagus and cauliflower are examples of foods ; turpentine and cubeb of medicinal substances which change the odor.

The *reaction of normal urine* is acid, excepting during digestion of a hearty meal, and possibly in some other conditions, and the acidity is thought to be generally due to the acid alkaline phosphates. It may also be due to a free organic acid, commonly lactic, but the rôle of this acid is a subordinate one. The urine is less acid in those who subsist upon vegetable food, and more so in those who consume much flesh meats.

It should constantly be borne in mind that urine, however normal or acid, will become alkaline by standing, and when mingled with even a small quantity of urine which has become alkaline, the change often speedily takes place.

A strongly alkaline urine would lead to suspicion of disease of the bladder or of the urinary passages, causing obstruction and preventing the complete evacuation of the urine.

When the urine is passed alkaline, an inquiry should be made as to whether the alkalinity is due to the breaking up of the urea and the production of ammonium carbonates, or to the fixed alkalis or carbonates taken as ingesta.

The reaction of the urine is determined by the litmus paper, and when the alkalinity is from ammonia, after exposure of the paper the volatile alkali will pass off and the red paper resume its original color, while if from a fixed alkali, the changed color will be retained.

The presence of albumen, of pus, and of some other abnormal products in the urine, their causes and significance, will be considered in connection with the morbid states in which they appear.

For further details respecting the conditions of the urine, the mode of detecting its various constituents, etc., the reader is referred to the special works on the examination of this important secretion ; but so much as has been stated seemed essential to a proper understanding of what is to follow on diseases of the kidneys.

DISEASES OF THE KIDNEYS.

General Phenomena.—The symptoms indicative of diseases of the kidneys are arranged by Bartels into different groups.

Some of these symptoms are confined to the region of the kidneys. These consist of subjective sensations—of pain, tenderness, or feelings

of discomfort ; and of objective phenomena—alterations in situation, size, or form of the kidneys, or their immediate surroundings.

Other symptoms result from the imperfect performance of the functions of the kidneys. These are manifested in conditions of the urine, in the departure of this secretion from its normal state. Many of these have been mentioned in the preceding remarks, and their importance in reference to diagnosis will readily be understood.

The other group comprises those constitutional conditions which characterize the retention of excretory matter, or the loss of elements from the blood by the wrong action of these excreting organs. These symptoms are manifested to a greater or less extent in nearly every part of the body. There is apt to be wide-spread malnutrition, disordered functions of the nervous system, and lessened activity of the whole body. The particular symptoms under these different heads will be described in connection with the special diseases in which they are manifested.

The diseases of most organs of the body are usually divided into organic and functional, but those of the kidneys are perhaps less susceptible of such a division than those of most other parts. There are many functional derangements connected with the urinary secretion, as we have seen ; but those not accompanied with structural changes of the kidneys depend, for the most part, upon derangements of the functions of other organs. Nearly all of the well-defined diseases of the kidneys are accompanied with perceptible changes of their structure.

A great variety of morbid conditions of the kidneys is met with, but many of them are combinations of simpler morbid elements, and to give all the varieties a separate consideration would be impossible ; and besides, they are not all capable of being clinically distinguished. A description of the well-recognized forms of renal disease will alone be attempted.

HYPERÆMIA OF THE KIDNEYS.

Hyperæmia of the kidneys, as of other organs, may be divided into Active and Passive.

Active hyperæmia, where the increased quantity of blood is largely in the arteries, is most frequently due to the action of irritating substances which the kidneys separate from the blood ; but it may also be due to the suppression of action in other parts, as in the skin, the liver, or the intestines, which are in functional sympathy with the kidneys, and also perhaps to vaso-motor paralysis leading to expansion of the vessels and a freer flow of blood.

Hyperæmia from these different causes often differs materially in character. That arising from the effects of irritating substances, such as cantharides (whether from being taken into the stomach or absorbed from the skin), turpentine, oil of mustard, cubebs, copaiba, nitrate of potash, or carbolic acid, readily passes into inflammation. The kidneys are engorged with blood, swollen, and often ecchymosed; the urine becomes albuminous, often bloody, and is usually small in quantity. Albuminous, blood, and epithelium casts are often seen in the urine, and in some rare cases the urine spontaneously coagulates. Fibrinous or bloody clots may form in the bladder, and obstruct the flow through the urethra. An acute, diffuse nephritis is apt to be fully developed. At the same time the bladder and urethra are more or less irritated and inflamed, producing strangury. These severe effects are more apt to be produced by cantharides; but oil of turpentine and the other substances are sometimes capable of producing all these symptoms.

From exposure to cold and wet, and suppression of the action of the skin, the congestion may result in inflammation, and especially when at the same time alcohol is freely taken.

In other cases, especially where the hyperæmia depends upon paralysis of the vaso-motor nerves, there is less tendency to inflammation, and a free secretion of urine, clear and watery, takes place. Impressions upon the central nervous system, or upon peripheral nerves reflected upon the kidneys, may produce this form of hyperæmia and these attacks of free secretion. In hysteria and various mental excitements these effects follow.

In the irritative form of renal congestion anodynes and diaphoretics are indicated, with mucilaginous drinks, rest in bed, and sometimes cathartics. A warm bath will often be useful, and in the severe cases a few doses of jaborandi will often procure prompt relief. Morphine and camphor are the anodynes most frequently prescribed.

The other varieties of active renal congestion with free secretion of urine require but little treatment. They are unirritating in character and generally temporary in continuance.

PASSIVE HYPERÆMIA OF THE KIDNEYS.

This is a more grave affection than the forms of active congestion which have been considered, since the causes producing it are much more serious and permanent.

The most frequent cause is obstructive disease of the heart, oftenest mitral insufficiency. Other valvular diseases, fatty degeneration, and sometimes obstructed circulation through the lungs, as in ad-

vanced stages of emphysema, some cases of fibroid phthisis, and rarely obstructions of the vena cava, or embolism of the renal veins may act as causes of this condition of the kidneys. When there is obstructed circulation through the heart or lungs, the venous pressure is increased and the arterial pressure is diminished. The blood circulates slowly through the kidneys, the secretion of urine is usually moderate, and when the cause continues long, important nutritive changes in the kidneys take place. A cyanotic induration occurs; the kidneys are enlarged, they become solid and firm; their capsule is not adherent, their surface smooth; the internal structure presents a dark bluish appearance, and a general condition somewhat resembling the nutmeg liver is present. The dark red color and the extreme hardness are the most characteristic marks of the long continued passively congested state of the kidneys.

Microscopically examined, the parenchyma of the kidney is not as much changed as might have been expected; but a degree of hyperplasia of the connective tissue is often found, and it is unusually tough; but there is much distention of the veins and capillaries, extending back to the Malpighian tufts.

This condition may continue for a considerable time without materially affecting the secreting function of the organs, though any moderate irritation may allow albumen or blood to escape and appear in the urine, and a scanty secretion with dropsical accumulations is apt to follow.

More serious secondary disease of the kidneys may take place. According to Jaccoud, catarrhal inflammation, or desquamative nephritis is likely to be set up; and according to Klebs, "a granular degeneration of the epithelial cells takes place, chiefly affecting those which line the curling cortical tubes; the cortical substance appears then of a pale grayish-red color, and stands out in marked contrast with the deeply cyanotic medullary substance."

Subsequent contractions of adventitious tissue may cause obliteration of vessels and tubes, and more seriously interfere with structures and function.

The dropsy which accompanies the advanced stages of cyanotic congested kidney is chiefly confined to those portions of the body drained by the ascending vena cava—the arms and head very generally escaping.

As this condition of the kidneys is dependent upon, and accompanied by, obstructive disease of the heart, the symptoms arising from the disease of the kidneys are mingled with those from disease of the heart. There is general venous congestion, dropsical accumulations, usually more or less cyanosis, and general derangements and debility.

The more distinctive symptoms are a moderate amount of albumen in the urine, frequently blood corpuscles, a small quantity secreted, usually highly acid, the specific gravity high, the color-usually dark ; and after standing an abundant deposit of urates takes place.

It is distinguished from the ordinary forms of Bright's disease by the obstructive lesions of the heart or lungs, *and by the absence of symptoms of uræmic poisoning*. The characteristic tubular casts of the different forms of Bright's disease will also be absent.

The course and prognosis of this affection will depend upon the disease of the other organs which gives rise to it. As this is commonly grave, the prognosis is unfavorable.

If, however, compensative action of the heart can be excited so as to raise the arterial tension and diminish the venous congestion, a free secretion of urine may take place, carrying off dropsical accumulations and causing great improvement in the symptoms. Digitalis and other heart tonics are therefore indicated, as was stated in treating of cardiac diseases.

But little can be expected from diuretics in relieving the dropsy, though some of the potash salts may have some effect. The acrid vegetable diuretics have little or no good effect ; and drastic purgatives often do much more harm in carrying off the peptones, upsetting the stomach, and debilitating the patient, than they do good by removing the dropsical fluid. Some gentle diaphoretics may be tried, and Bartels advises the Turkish or hot-air bath, while Liebermeister recommends the hot-water bath as a means of inducing perspiration and relieving the system of the dropsical fluid.

Mechanical means for removing the fluid should not be hastily resorted to. Scarification of the limbs is apt to be followed by erysipelatous or gangrenous inflammation; but I have not seen the fine punctures with a pin or needle followed by unpleasant effects. Paracentesis of the abdomen may be called for as a palliative measure, when the accumulation is very great and respiration is seriously interfered with.

ACUTE DESQUAMATIVE NEPHRITIS.—ACUTE DIFFUSIVE NEPHRITIS.—CATARRHAL NEPHRITIS.—ACUTE BRIGHT'S DISEASE.

These and still other names are given to an acute inflammation of the kidneys, involving especially the tubules, causing desquamation of their epithelium, but often extending to other parts of the organ, and producing changes in the parenchymatous structure. It is an extension of disease a degree further than the active hyperæmia

already described, and is accompanied by albumen in the urine, often blood, and generally casts of the uriniferous tubes.

It is produced by much the same causes operating more intensely or for a longer period than those which produce irritation and congestion.

It is more frequently a secondary than a primary affection, but may be produced primarily by exposure to cold and damp, especially in connection with alcoholic indulgence, and by irritating ingesta. It may be produced by extension of inflammation from the urinary mucous membrane, in cystitis and urethritis; by the absorption and elimination by the kidneys of irritating substances, such as cantharides, turpentine, etc., and by suppression, by whatever means, of the action of the skin, the liver, and the intestines. It occurs in certain fevers as the result of the causes which produce other phenomena of those affections; and, most frequently of all, it occurs in *scarlatina* commonly about the period of desquamation.

Morbid Anatomy.—The anatomical changes vary in different cases. Ordinarily the volume of the kidneys is not materially increased, and in some cases the appearance of the organ is so little changed as to require the use of the microscope to detect any morbid conditions. In the more severe cases there may be spots of ecchymosis under the capsule, the organs are somewhat enlarged, and red patches are mingled with opaque, grayish, or yellowish-white portions of the surface. On section a similar mottled appearance is often observed, and red points, the result of congestion of the Malpighian bodies, or of effusion of blood, may be seen. In many cases the pathological changes seem limited to the straight tubes, beginning at their summit and progressing toward the base.

As the inflammatory process advances it leaves some portions and invades others, or affects the different parts differently, and hence distinct zones or alternations of red and white stripes are seen—the white produced by dilated tubules full of aborted epithelium, while the red correspond with portions that have recently become hyperæmic.

The epithelial cells are swollen and adherent to each other, and more or less to the walls of the tubes; and when separated they pass out with the urine, constituting the *casts* so characteristic when found. These cells are often granular; sometimes the granules are mingled with fat, degenerative processes having occurred.

When casts are expelled, new epithelial cells again line the tubes, and go on to the production of other casts. When the hyperæmia is great, blood-vessels are apt to be ruptured, and blood corpuscles and blood pigment are found mingled with the epithelium of the

casts. The capsule in these acute cases is easily separated. Ordinarily resolution takes place and the kidneys are restored to their normal state. In some cases, however, especially in scarlatina, the process goes on to the production of more serious results—to a more wide-spread and persistent parenchymatous nephritis, or well established Bright's disease.

Symptoms.—The symptoms and progress of acute desquamative nephritis vary in different cases. In most cases, especially of the secondary forms, the symptoms are confined to a change in the urine. In those primary cases produced from taking cold, for a few days there may be an acute fever, with the general accompanying phenomena, with pain in the back and tenderness in the region of the kidneys; but very often nothing to specially indicate the disease of the kidneys will appear without an examination of the urine. The change in the urine is often the only key to the condition present. Without an examination of the urine secondary cases would be likely to be entirely overlooked.

The urine is acid, the quantity may be normal but is usually diminished during the first days of the disease, owing to the obstruction of the separated epithelium in the tubules. When this obstruction is removed, the quantity of the urine is increased and sometimes beyond the normal. The density is increased when the quantity is diminished, but returns to its normal specific gravity as the quantity is again augmented. Blood is sometimes present, but usually in very small amount. There is, however, *always albumen*, resulting from a change in the epithelium of the tubules, and possibly also in the blood pressure.

On standing, the urine generally presents a deposit composed of mucus and epithelium, the latter, either separate or united, forming casts. One attack disposes to others, and care should be exercised until complete restoration occurs.

The duration of an ordinary attack is from a few days to two or three weeks, though very seldom beyond fifteen days. If by that time the albumen does not disappear from the urine, the correctness of the diagnosis of simple catarrhal disease should be suspected; and if the attack continues beyond three weeks, a more permanent or deep-seated disease than mere acute desquamative nephritis is present.

The *diagnosis*, as in other diseases, is to be made out by carefully observing the phenomena, and by comparing them with those of other morbid conditions which resemble them.

It is to be distinguished from passive congestion of the kidney, arising from heart disease and other obstructions to the venous circulation, by the history of the case, by the evident complications in

the latter, and the absence of acute febrile symptoms or local pains in the more chronic disease. In both there is albumen in the urine, and often blood, but the latter is apt to be greater in amount in the congestive cases; and these are longer in continuance and are accompanied by persistent dropsical conditions.

Diffused or more severe parenchymatous nephritis is distinguished from the more superficial or catarrhal form by the gravity of the general condition, by the greater lumbar pains, by the more notable presence of blood in the urine, by an early appearance of dropsical effusion, and by the longer persistence of the disease. In the simple catarrhal variety uræmic poisoning is very seldom present, but in the parenchymatous uræmia often supervenes.

In catarrhal nephritis arising from extension of urethral or vesical inflammation the symptoms will be mingled with those of the primary affection. The urine is then apt to be more free in quantity, more pale in color, less acid, and sometimes even alkaline in reaction, with the appearance of pus corpuscles and phosphates.

Simple catarrh of the kidneys is often transient and attended by slight symptoms, and doubtless not unfrequently passes without notice. When it is more severe, and the inflammation extends to the parenchyma, the symptoms are more marked and of longer continuance. The greater sense of illness; the pains; the dropsical symptoms often first noticed under the conjunctivæ and in the subcutaneous tissues about the eyes, but soon extending to the lower extremities, the scrotum, or labia; the diminished quantity of urea in the twenty-four hours, the evidences of its accumulation in the system; the more notable quantity of blood in the urine, and generally the larger quantity of albumen and the morphological elements it contains, will distinguish the more severe form of the disease from the milder.

Treatment.—The treatment of the milder forms of this affection is simple. In the primary forms of the disease it often speedily subsides on the removal of the exciting cause. When the elimination of the irritating materials has taken place, the parts often soon return to their normal condition, and the albumen disappears from the urine. These results will be favored by rest in bed, by the free use of diluent drinks, by a light diet, by mild cathartics, and by a warm bath and gentle diaphoretics. As the irritation subsides, freely drinking simple water will tend to remove the casts of epithelium and wash away other retained materials. Recovery should not be considered complete until the urine contains no albumen.

In these milder, as in the severer forms of nephritis, an almost or quite exclusive milk diet is beyond question the best.

ACUTE PARENCHYMATOUS NEPHRITIS.

Acute parenchymatous nephritis is a more severe affection, and often requires more care and more active management, though the treatment is to be conducted on the same general principles. Here the inflammation is diffused over a greater portion of the textures, more albumen is exuded, less urea is excreted, much more dropsy occurs, uræmic symptoms, often of a severe character, are likely to take place, and permanent injury to the kidneys not unfrequently follows. It is apt thus to become merged into a more distinctive form of Bright's disease, soon to be described. The immediate danger to life is from uræmia, and from the complications which are liable to occur.

Coma and convulsions are always dangerous, but recovery may take place after they have set in. Pleuritis, pericarditis, peritonitis, meningitis, or pneumonitis, when occurring in this affection, is apt to prove fatal.

Œdema of the lungs is also dangerous, and so is an effusion into both pleural cavities. Though an acute parenchymatous nephritis may terminate in a chronic form of disease, this is not common, and it tends to recovery. If the patient escapes acute uræmic poisoning and the complications mentioned, recovery in a few weeks, or at farthest in a few months, may, as a rule, be predicted.

As long, however, as casts remain in the urine, the danger is not entirely past. The urine may become very scanty, and uræmia may take place from blocking up of the tubes. Still, casts may be discharged after the albumen disappears and the active disease has subsided.

Treatment.—The special objects of treatment are to arrest the inflammation and prevent these results, to palliate symptoms, relieve the uræmia and dropsy, and restore the proper functions of the organ.

The particular treatment of the albuminuria and dropsy following scarlet fever was described when that disease and its sequelæ were discussed.

When the nephritis is primary and the result of taking cold, blood-letting, general or local, may be required, but under the same conditions and restrictions as in other local inflammations. Elimination cathartics and diaphoretics are particularly called for, and the warm water or steam bath, or the hot-air bath, may be very useful. The effects of uræmic poisoning upon the nervous system are to be combated by the means presently to be noticed.

Dry cupping over the loins is perhaps the best means of revulsive counter-irritation, and this may be followed by fomentations.

As the kidneys would be irritated by stimulating diuretics, instead of responding to their action in increased secretion, these agents are not indicated. The urea, however, may be eliminated by the intestines and the skin, and hence cathartics which produce free secretions from the bowels are indicated in as free doses as the strength of the patient and condition of the stomach will admit. As a means of increasing the secretion from the skin, jaborandi and its derivative pilocarpin are the most efficient remedies we possess. They are especially applicable where the strength of the heart will allow of their use. Still digitalis, in decided doses, and bitartrate and other salts of potash may be borne and prove useful. In subacute stages of the disease diuretics of a more stimulating character may be ventured upon, but they should always be used with care, and their effects observed. Should irritation of the kidneys be induced, they must be immediately discontinued.*

Rest in bed is essential, and a bland, chiefly a milk, diet should be enjoined.

When convulsions occur eliminatives should be vigorously pushed; but in the meantime, as palliative measures, blood-letting, especially in vigorous patients and in acute cases, is often useful; and chloroform, chloral hydrate, and bromide of potassium may often be used with advantage. They tend to remove reflex irritability and often arrest the convulsions. Morphine hypodermically is sometimes advised, and in cases of great irritability may be ventured upon, but not in toxic doses. Prof. Loomis, of New York, recommends morphine hypodermically, in very large doses, in uræmic convulsions, and reports success with its use; but the quantity he recommends (half-grain doses repeated until the convulsions are arrested or a profound impression is produced) has not received the general sanction of the profession.

Care as to exposure and ingesta must be exercised during convalescence.

Before proceeding to an account of the affections of the kidneys generally treated of under the name of Bright's disease, it will be well

* Trousseau's diuretic wine is composed as follows :

R Juniper.....	3x
Pulv. Digitalis.....	3ij
Pulv. Squills.....	3j
Wine	Oj

Macerate for four days, and add

Acetate of Potash.....	3iij
------------------------	------

Express and settle. Table-spoonful three times a day.

to describe briefly a few other conditions of these organs, some of which have a resemblance to those affections and have sometimes been included with them.

PARENCHYMATOUS DEGENERATION OF THE KIDNEYS.—FATTY DEGENERATION.—AMYLOID DEGENERATION.—TUBERCULOUS DEGENERATION.

These degenerations occur in various conditions of the system and in different forms of renal disease. They may be the result of inflammatory processes or they may occur without them. When they are the result of inflammation, and are preceded and accompanied by the phenomena of Bright's disease, they are regarded as a part of that affection; but it is not thought to be desirable to include them under that head when they are unattended by any inflammation.

In parenchymatous degeneration of the cortical substance of the kidneys there is a cloudy swelling, and the affected part is of an opaque, grayish color. The surface of the organ is smooth, the capsule easily detached, the substance is less firm in consistence, and the striæ are obliterated or less distinct than in health.

Under the microscope the epithelial cells of the convoluted tubes are seen swollen and filled with albuminous granules; but as there is normally more or less of a granular appearance of these cells, unless the change is great the distinction between the normal and diseased structure is not readily made. The macroscopical appearances are often more distinctive than the microscopical.

When this change does not arise from inflammation of the kidney, its most frequent causes are the poisons and heat of the infectious fevers. Certain mineral poisons are also capable of producing this form of degeneration. In pyæmie, septicæmie, diphtheritic, exanthematous, and continued fevers this change is not unfrequently found; and it is also present in poisoning from arsenic, phosphorus, antimony, and the mineral acids. Extensive burns and other extensive irritations of the skin have been followed by this degeneration.

Fatty degeneration of the kidneys often arises from causes similar to those that produce the preceding parenchymatous degeneration, and is often mingled with it. Granulo-fatty degeneration is not unfrequently observed. The cortex, when fatty, is swollen and pale, with streaks and patches more yellow than the rest. Hemorrhagic spots, particularly in phosphorus poisoning, are often present. The microscope shows the epithelial cells of the convoluted tubes degen-

erated, and treating them with ether shows their fatty character. The glomeruli remain unchanged in both parenchymatous and fatty degeneration.

Fatty degeneration here, as elsewhere, is the result of lowered vital action, and this may be produced by an anæmic condition, and is apt to occur in pernicious anæmia and leucoeythæmia, in the cachexia of pulmonary tuberculosis, in chronic alcoholism, and sometimes in diabetes.

In old age with obesity, and in jaundiced conditions, fatty degeneration of the kidneys is met with.

Parenchymatous degeneration of the kidneys is regarded by some as a stage of Bright's disease, and it is attended by a moderate degree of albuminuria. But this form of disease is often transitory, passing away with the causes that produce it; and this, as well as fatty degeneration, may be present without the appearance of albumen in the urine. True Bright's disease is not thus transient, and the presence of albumen is a necessary condition.

In different forms of jaundice of great intensity and continuance, hyaline or transparent casts are found in the urine, and often where no albumen is present.

Amyloid Degeneration of the Kidneys, often placed under the head of Bright's disease, may nevertheless be regarded as differing from its ordinary forms. It has the characteristics and causes of the same degenerative process in the liver, spleen, and elsewhere. It is distinguished by the peculiar reactions with iodine, by which it is colored a mahogany brown; with iodine and sulphuric acid, which color it blue; and with methyl-violet, which colors it red. The material is nitrogenous, but has a general appearance resembling lard or wax.

It occurs in chronic tuberculosis, in prolonged suppuration from whatever cause, and in the syphilitic cachexia.

In amyloid degeneration of the kidneys the middle walls of the arteries are said to be first attacked; and the deposit commences first in the Malpighian glomeruli. The arterioles, the efferent vessels, and the capillaries, are attacked in succession. The walls of the vessels are thickened, their calibre is diminished, and this is followed by ischæmia in the parts supplied by such obstructed vessels. The epithelial cells are not always but often invaded, and when so, the disease reveals itself in disorders of the urine. The kidney is hard, heavy, pale yellow, and lard-like, the cortical substance is swollen, the capsule is easily separated, and the surface is glistening or granular. The tissue, on being cut through, presents red spots which are the glomeruli infiltrated with amyloid substance. In some cases fatty

alterations coincide, the latter changes taking place in the epithelium or in the interstitial substance. In these cases the amyloid change is supposed to be secondary, and to this condition Virchow has given the name of Parenchymatous Nephritis with amyloid degeneration.

This degenerative change of the kidney is secondary to the other affections named, is particularly liable to occur where there is suppurative disease of the bones, is obscured in its manifestations by the primary affection; and the morbid change develops itself quite insidiously, or, so to speak, without symptoms. (Bartels.) The functional disturbances of the kidney vary much in different cases, but as a rule they secrete abundantly—though this action is diminished toward the close of life. The urine is clear, often very pale, though when in small quantity, as sometimes is the case, it may be clouded with urates.

Albumen is present in the urine in considerable quantity, and without its presence there are no means of distinguishing the disease during life. It is seldom that casts are found in it in any considerable number, especially when the quantity of urine passed is large; and those found, or nearly all, are of the narrow or hyaline variety. In cases where the casts are abundant, the number of wide ones exceed the narrow, and some that are dark and granular may be seen. The wide casts show the reaction of amyloid matter with iodine.

Most of those who have amyloid degeneration of the kidney become dropsical, though some remain free from dropsy to the end. The dropsy is most in the lower extremities and the abdomen, though the face may show it markedly; but, according to Roberts, it is seldom in the pleura or pericardium. The dropsy, when it appears, is persistent, especially in the abdomen, though the secretion of urine is abundant. This and other circumstances render uncertain the influence the renal disease has upon the dropsy.

Diarrhœa not unfrequently occurs during the latter stages of the disease, and is exhausting and nearly always fatal. Vomiting occasionally takes place, and when it occurs is no less exhausting than the diarrhœa. Other symptoms of uræmia are rare.

The duration of this disease of the kidneys will vary, depending upon the other diseased conditions which accompany it; and the fatal result which so commonly follows is due more to those other morbid states than to the disease of the kidneys.

The *diagnosis* cannot be made, positively, from any pathognomonic signs or symptoms. It is to be inferred from considering the accompanying conditions which have acted as causes. When albuminuria and dropsy occur in old syphilitic patients, in consumptives who have

had cavities and suppuration in the lungs for some time, in patients who have had long-continued suppurations in connection with disease of the bones, and especially if there be great anæmia and enlargement of the spleen or liver, amyloid degeneration of the kidneys may be presumed.

It is to be distinguished from chronic parenchymatous nephritis by the urine in the latter being turbid, depositing a considerable amount of sediment, by its containing an abundance of casts of different varieties, with often an abundance of blood corpuscles; while in amyloid disease the urine is clear and rarely forms a sediment, it contains few casts and those of a hyaline variety, and very seldom contains blood corpuscles. The quantity of urine passed in amyloid disease varies, while in chronic nephritis it is pretty uniformly small.

It is seldom that this form of kidney disease occurs unless other organs are affected in a similar way—especially the spleen and liver; and when they are enlarged the other symptoms enumerated become more conclusive of degeneration of the kidney.

Treatment.—The most important treatment by far is the preventive, which will consist in removing the cause.

Syphilis, suppurations, malaria, etc., must be thoroughly dealt with, and, if possible, removed.

Various remedies have been recommended with a view of acting upon the amyloid disease itself. The carbonates or the vegetable salts of the alkalis, nitric acid, and other remedies have had their advocates. Bartels has had such results from iodide of potassium that he declares his intention in the future to urge the continuous use of this medicine, though he states he does not know in what manner it acts upon the diseased walls of the vessels. At the same time a generous diet should be allowed, and also iron and other tonics. The action of the skin should be kept up by baths, special symptoms should be palliated, and all hygienic rules observed.

ANÆMIA OF THE KIDNEYS.

The suppression of the urinary secretion, which occurs in cholera, is attributed by Prof. Flint and others to anæmia of the kidneys. That a marked deficiency of arterial blood flowing to the kidneys will interrupt their secretion has been proved by experiments upon animals and by pathological observations. In the slow circulation of the thick and dark blood in the asphyxiated stage of cholera, the urinary secretion is sometimes entirely suppressed, and when reaction takes place and the secretion is restored, it is often albuminous and

abounds in casts. Speedy degenerative processes are known to have occurred ; but whether these results have depended upon the anæmia or the poisonous condition of the blood may not be so clear.

Spasm and emboli of the renal arteries are thought to be causes of suppression of secretion, of scanty and albuminous urine. In lead colic, strychnine poisoning, in some cases of epilepsy, and in tetanus, spasm of the vessels of the kidney from irritation of the vaso-motor nerves is thought to be the cause of temporary albuminuria and diminished secretion.

The *treatment* in all such cases must be directed to the removal of the cause ; but when complete suppression of urine continues for a sufficient time to induce uræmic symptoms, the secretion is very seldom if ever restored. A fatal termination, especially in cholera, is the almost inevitable result. Unless some method of treatment different from that hitherto used be discovered, such result will continue to follow.

Tubercular disease of the kidneys sometimes occurs, but it is secondary to pulmonary tuberculosis, and was mentioned when treating of that affection. In one case recently under my care, persistent slight hemorrhage from the kidneys occurred in a tuberculous subject, where no other cause for the bleeding could be found, and where tubercle of these organs was suspected. It presents the miliary and caseous forms of the disease, and pursues a course similar to tubercle in other organs.

The pathology of tubercle of the kidneys presents the same questions as that of the tubercle of other organs, and need not be entered upon here.

The symptoms will consist of pain in the region, though it may be absent; of small or moderate quantities of blood in the urine, which may be scanty in quantity and may contain albumen ; and often, under the microscope, epithelium and a whitish, clotted, amorphous substance appear, composed of small points, insoluble in acetic and nitric acids or by heat. Tenesmus of the bladder is sometimes observed ; and a renal tumor may occasionally be felt.

As tubercle of the kidney is of the same obstinate and progressive character as tubercle elsewhere, and is so generally associated with even more advanced tubercle of the lungs, the prognosis is unfavorable, and the course of the disease is more or less rapid, depending much upon the general state of the system and the amount of disease elsewhere.

The treatment of tubercle of the kidneys will be merged into that of the general tuberculous disease, with such special palliative measures as the special renal symptoms may require.

BRIGHT'S DISEASE OF THE KIDNEYS.

Since the investigations and publications of Dr. Richard Bright, of England, about half a century ago, a certain class of diseases of the kidneys, characterized by albuminuria and dropsy, has been called by his name. The pathological changes of the kidneys resulting in these symptomatic phenomena are various, and some of them have been considered in the preceding pages. The term Bright's disease is made to comprehend more by some authors than others; and this has led to confusion in discussing this subject. Some have practically discarded the term, and have treated of all the diseases of the kidney under other and more distinctive names. This will probably be the ultimate method of treating the subject; but at present these affections are not all sufficiently differentiated to make this imperative; and the commingling of various pathological elements in many of the cases renders the retention of the general term of Bright's disease convenient, and custom has rendered it proper. Prof. Flint does not include under this name simple parenchymatous degeneration, fatty degeneration, hyperæmia or anæmia of the kidneys; and I have also excluded, contrary to the custom of most writers, ordinary amyloid degeneration, as this does not necessarily depend upon an inflammatory process, and results from other causes than those which usually produce Bright's disease.

Jaccoud, however, includes renal stasis (the cardiac kidney already discussed), parenchymatous nephritis, amyloid degeneration, and renal sclerosis. Acute parenchymatous nephritis is so generally secondary—produced by scarlatina, diphtheria, or other acute diseases, and by the condition of pregnancy, and its symptoms are so mingled with the phenomena of those conditions, that a further consideration of this form of renal disease in this connection seems not to be demanded. This is a severe and dangerous complication when it occurs in the course of any disease, since it adds to these diseases the element of a local inflammation of the kidneys, and the very grave phenomena of uræmia.

Under the head of Bright's disease I shall consider chronic parenchymatous inflammations of the kidneys and their results, particularly sclerosis and granular changes.

CHRONIC BRIGHT'S DISEASE.—CHRONIC DIFFUSED NEPHRITIS.—CHRONIC INTERSTITIAL NEPHRITIS.—SCLEROSIS OF THE KIDNEYS.—GOUTY KIDNEY.

It is now generally agreed that the term Bright's disease shall be held to indicate a diffused nephritis. It affects both of the organs and their different tissues. Generally the interstitial tissue, the uriniferous tubes, the blood-vessels, and the lymphatic elements are all at length involved. The word diffused does not imply that all parts of the kidneys are equally affected. Some parts are nearly always more diseased than others, but the inflammation is not confined to any special tissue or part.

Etiology.—The common form of chronic Bright's disease is usually produced by exposure to cold, by alcoholism, by irregular habits, and by those other causes which are less readily specified, but which produce slow inflammatory processes in other parts of the system. Though it is perhaps not so frequently produced by alcoholism as was formerly supposed, yet in a majority of cases coming under my observation the use of alcohol has been indulged in, though by no means always to the extent of drunkenness. But the use of this agent far short of drunkenness deranges and deteriorates the nutritive processes, and the alcohol, being carried out of the system to a large extent by the kidneys, is liable to irritate those organs, inducing a slow inflammatory process, and ultimately degenerative changes. Malnutrition of various kinds, imposing upon the kidneys the task of carrying out of the blood abnormal materials, tends to the same result. Chronic Bright's disease is not unfrequently associated with similar slow inflammatory processes in other parts of the system, with chronic interstitial pneumonitis, with chronic hepatitis, and hysteritis. It then becomes a part of a general, instead of a strictly local disease.

Gout and rheumatism, especially the former, the English observers regard as having an effect in the production of the disease, and doubtless they often have that influence. The febrile exanthemata, especially scarlatina, are well known to produce acute nephritis, which sometimes, though rarely, terminates in the chronic form; but these affections oftener produce a catarrhal or desquamative than a more diffused inflammation, and cannot be reckoned among the frequent causes of chronic Bright's disease. Indeed, albuminous urine may occur in fevers and other acute diseases where there is no evidence of positive inflammation.

As stated by Jaccoud, the causes vary with the country. In England gout is a frequent cause; in Scotland a more decided form of

alcoholism ; in Norway and Sweden alcoholism, though not as often as in Scotland. In France it is supposed to be more frequently due to malarial influences, though the combined influence of alcohol in the wines so commonly used, and the absinthe occasionally indulged in, contribute to the result.

In America malaria may have an influence, but it is doubtful whether its prevalence in malarial localities is greater than in those free from a malarious influence. Mental depression and anxiety are reckoned among the causes of Bright's disease, and doubtless many influences which tend to lower the vitality and derange the nutrition and secretions of the system contribute to the production of the disease.

Pathology.—The pathological anatomy of the affections which have been placed under the head of Bright's disease varies in different cases, the variation depending upon the tissues most involved, and upon the extent and particular character of such involvement.

The pathological process which occurs has been very properly divided into three stages—Congestive, Exudative, and Retrogressive. The *congestive period* is when there is an active fluxion to the kidneys, increasing their volume and weight. The glandular elements, the glomerules of the Malpighian bodies, are most affected, appearing to the naked eye as small red prominences. The tubuli, both straight and contorted, are implicated ; the epithelial cells, particularly of the contorted tubules, are swollen ; the capsule presents a granular appearance, and exudations into the tissue begin to appear. According to recent investigations of Trunke, the most important primary modification in the early stage of the inflammatory process is an enlargement of the intertubular interstices produced by accumulations of lymphoid corpuscles within the spaces which surround the Malpighian bodies and the tubuli contorti. These lymphoid accumulations in the interstices are said to be primary, while the alterations in the epithelium within the tubes and other changes are secondary.

The epithelial cells become infiltrated and multiplied, filling and enlarging the tubes, pressing upon and obstructing the blood-vessels, producing an anæmic state of the cortical substance as compared with the hyperæmic medullary portion. Hypertrophy of the interstitial connective tissue follows. This constitutes the exudative stage, or *stage of enlargement*.

The kidneys are soft, and often double their normal size, and the enlargement is in the cortical substance. The infiltration and pressure upon the blood-vessels exclude the blood and cause a lighter color, thus constituting the *large white kidney*.

The retrogressive period comes on after an indefinite time. The

epithelial cells undergo a fatty transformation, and are changed to a fatty detritus; the fundamental membranes of the tubes are changed, and the parenchyma is atrophied. We have now the *fatty and contracting kidney*.

The onset of this stage is marked by the presence in the urine of grannlo-fatty casts. The increase of connective tissue which takes place does not compensate for the collapse of the parenchyma, and the kidneys are diminished in size. The atrophy may be nearly uniform, when the surface will be comparatively smooth; but usually some parts are more atrophied than others, when the surface is unequal and presents a granular appearance.

This simple diffused parenchymatous inflammation does not give rise to as general and complete atrophy as is produced by renal sclerosis or interstitial nephritis, which produces the *small contracted kidney* of English authors.

To the naked eye the capsule is opaque and appears thickened, and is now often adherent. The color of the surface is a whitish yellow. It is hard, shriveled, and somewhat like leather. The cortical substance envelops the central part like a shell, destroying more or less its secreting power.

Some of the uriniferous tubules are distended into cysts, which often contain leucin and tyrosin, and the kidney as a whole becomes greatly impaired in its functions, leading to a train of symptoms and complications which constitute the phenomena of advanced Bright's disease.

Various anatomical *complications* are generally found. Very rarely the kidneys alone are affected. There are inflammations of serous membranes, catarrhal, and sometimes ulcerative inflammations of the mucous membranes, and there are visceral lesions. There are apt to be peritonitis, pericarditis, and pleuritis, laryngo-bronchial, gastric, and intestinal catarrh, and ulcerative inflammation of the intestines, pneumonia and hypertrophic lesions of the heart, spleen, and liver, and amyloid degeneration of different organs.

Symptoms.—The symptoms and diagnosis of this most common form of Bright's disease are now to be considered. The mode of onset varies with the cause. Those forms of the chronic affection which follow more acute attacks will be preceded by an abrupt invasion. As the result of exposure and sudden taking cold, of injuries, or scarlet fever, there will be chills, fever, lumbar pains, and vomiting; and after some days general anasarca supervenes, and more or less marked uræmic symptoms are apt to appear. These are the phenomena of acute diffused nephritis, and a favorable termination often follows in from two to three or four weeks. In some of these cases the dis-

ease abates but does not disappear, and a subacute and finally a chronic form supervene.

In a large majority of cases of chronic Bright's disease, the affection at first is mild and insidious and the onset is gradual. In many cases the first observed phenomenon is that of dropsy. Very slight at first, it will gradually increase until it becomes too evident to be longer overlooked. There may be at first some feelings of indisposition, moderate pains in the back, and laryngo-bronchial catarrh which becomes persistent. Disorders of vision may appear, and an ophthalmoscopic examination will show abnormal conditions of the retina. There are, besides, cephalalgia, possibly vomiting and diarrhoea, and some emaciation. More rarely the beginning is marked by insomnia, by more frequent micturition, with an increase in the quantity of urine.

Albumen has usually been present in the urine before any of these symptoms become marked. Whenever any of these symptoms appear, indeed when any material indisposition for a length of time has occurred, the urine should be examined. Albumen in these cases will be found, and often in abundance, and casts will probably be present.

The *urine* in acute cases will be diminished in quantity, and increased in density. The color is often red from the presence of blood. The albumen in these cases will be in great quantity, and when coagulated by heat and nitric acid, it will present a reddish appearance. White as well as red blood corpuscles will be present, together with renal epithelium and fibrinous casts. When the hæmaturia has disappeared, the fibrinous casts are replaced by epithelial or colloid casts. Urea and the phosphates are deficient. When the disease goes on to this stage, or presents these appearances, recovery is at least delayed.

An intermediate stage may now follow. The quantity of urine may be about normal, reaction acid, density somewhat below the normal, but varying with the quantity secreted (from 1.022 to 1.012), and the urea, uric acid, chlorides, and phosphates are deficient. The albumen is now about the same, and the morphological elements—the epithelial cells and fibrinous casts of the uriniferous tubes—do not differ much from the preceding stage.

In the *chronic stage*, whether the first onset be abrupt or insidious, the urine becomes comparatively pale, the reaction feebly acid, there is often froth remaining upon its surface, the quantity is variable, sometimes above the normal, but the density is always *below* the normal, and is often as low as 1.004. The albumen is *increased*, often largely; all the normal urine constituents except water are decreased, and renal epithelium with granulo-fatty casts now are

found. In gouty nephritis the urine abounds in urates, in uric acid, and in casts studded with urates. In cases complicated with malaria or jaundice, the casts may be charged with pigments.

The *blood* in the early stage has an excess of fibrine. In the chronic stage the serum is diminished in density from 1.030, the normal, to 1.025 or 1.020. This is due to the loss of its albumen by the kidneys, and will be in proportion to the abundance of albumen in the urine. The amount of albumen in normal blood is from seventy to eighty parts per thousand. In Bright's disease it is reduced to fifty, forty, or even thirty parts in one thousand.

In some cases the albumen of the blood, as stated by Jaccoud, undergoes molecular changes, in consequence of which it circulates in globules suspended in the serum, giving it an opalescent appearance—globules insoluble in ether, but soluble in acetic acid. It is probable that the albumen undergoes other changes in its physical or vital properties, which render it more easily transmissible through the tissues of the kidneys. The amount of urea in the blood is four or five times as great as in the normal state. The proportion of red corpuscles is not materially changed at first, but as the disease advances they are decreased, and an anæmic condition appears at last. The skin is usually dry; but the establishment of diaphoresis at the earlier stages of the disease is a favorable sign.

Dropsy, so very generally present sooner or later, is in rare cases (one in twenty—Rosenstein) absent; and it sometimes disappears at the stage of renal atrophy. It may come on suddenly or very slowly, generally gradually. In 406 fatal cases there was hydrothorax in 82, hydrocephalus in 21, hydropericardium in 72, pulmonary oedema in 115, and oedema of the glottis in 4.

The dropsy is not entirely due to the deficient secretion of water from the kidneys, since it sometimes occurs when the bulk of the urine is at the normal standard, or above, and must be dependent upon either a change in the serum of the blood, or in the tissue of the serous surfaces. The excess of urea in the system may change the condition of those surfaces, and induce an excess of exudation.

Retinitis is rather a symptom than a complication of Bright's disease. This comes on slowly, impairing and sometimes destroying vision. The lesion is either in the nervous substance or in the connective portion of the retinal tissue, and results in fatty degeneration or sclerosis.

There are various accessory symptoms present in the course of Bright's disease. Vomiting of a glairy acid matter sometimes occurs, increasing in frequency as the disease progresses, and a diarrhœa is not unfrequent, which sometimes becomes habitual, and is accompa-

nied by a catarrhal condition of the intestinal membrane. The intestinal discharges often become alkaline from the decomposition of urea which is eliminated by the bowels. The stools often contain albumen.

Bronchial catarrh often occurs, coming on slowly, and in the latter stage it may be marked, accompanied with free expectoration.

Hypertrophy of the heart, independent of valvular disease, often accompanies this affection; it is produced by obstructed circulation through the kidneys, and is limited to the left ventricle. Dilatation follows as in other cases of obstructed blood-flow. This occurs in the chronic stage, and is more common in interstitial nephritis than in the other forms of Bright's disease, as in this the obstruction to the circulation is greatest.

While the *duration* of acute parenchymatous nephritis is from two to five weeks, where it terminates in resolution, there is no definite limit to the chronic form. The continuance of the disease depends upon the power of endurance, the amount of albumen lost, the amount of urea in the blood, and the complications which may be induced.

The progress is not always continuous. Remissions may last for weeks, and they are determined by the diminution of the albumen and by the urine regaining its normal proportion of natural constituents.

Amelioration of the retinitis is a real sign of improvement.

While the acute form of Bright's disease often terminates favorably, the chronic form is very seldom cured.

The *prognosis*, therefore, is very unfavorable as to recovery, death usually occurring within two years after the disease is fully recognized, and sometimes within a few months, or, indeed, within a few weeks. Many cases, however, may be much prolonged by treatment, and when the stage of contraction is reached the patient may remain tolerably comfortable for a long period. Sooner or later, however, the dropsy returns, uræmia may suddenly occur, or some of the complications may intervene to terminate the case. The occurrence of pneumonia, of œdema of the lungs or of the glottis, or severe uræmic symptoms, are particularly unfavorable. Death may result from feebleness due to the loss of albumen, or to the intestinal catarrh and diarrhœa, as well as to the uræmic poisoning. Uræmic poisoning is less likely to be the cause of death when diarrhœa occurs, but the latter may produce a fatal exhaustion.

In the preceding account there has been more particular reference to chronic diffused parenchymatous nephritis. Interstitial nephritis,

or renal sclerosis, presents some peculiarities in pathology and symptoms which require notice. It should be stated, however, that these two forms of Bright's disease—the diffused and the interstitial inflammation—run into each other pathologically, and are not always distinguishable from each other symptomatically. It is seldom, perhaps, that an inflammation is strictly confined to the connective tissue, and therefore seldom that we have a simple interstitial nephritis, and in diffused inflammation of the kidneys the interstitial tissue is more or less involved. When, however, the inflammation is confined chiefly to the connective tissue, and sclerosis is the principal anatomical result, the symptoms and course of the disease vary from those which have been sketched.

In some cases where sclerosis and contraction are the chief ultimate results, there has not been a distinct primary process of interstitial inflammation—the interstitial lesion which constitutes it being an element of a diffused nephritis. In other cases the interstitial disease may be primary and more isolated, but not declared by marked symptoms during life. There is very little or no albuminuria, dropsy, or other evidence of the ordinary form of Bright's disease.

In another class of cases the prolonged congestion and irritation cause hyperplasia and sclerosis of the interstitial tissue, interfere with the nutrition of the glomeruli, the glandular elements, and the epithelium of the tubules, and produce persistent albuminuria with its consequences. Here the primary change is the cirrhotic process, and the other lesions are secondary. As in cirrhosis of the liver, contraction of the connective tissues interferes with circulation, nutrition, and function, so in the kidneys similar pathological conditions result.

In renal sclerosis the invasion is insidious or latent. There may be no pain, and for some time albuminuria is absent, and when it occurs is but slight. At length there may be polyuria, but with decrease of urea and other organic elements. There will be obstructed circulation through the kidneys, arterial tension, and comparatively early development of hypertrophy and dilatation of the heart, *without valvular lesion*. There will be little, and often no noticeable œdema, serous inflammation will not be very frequent, and ocular symptoms will be rare.

Hemorrhages, however, are apt to occur, particularly epistaxis; and sometimes convulsions and coma, followed by death, quite unexpectedly take place.

The duration of this form of disease is indefinite, but it is always chronic and may remain for years undiscovered. When proper precautions are taken, life may be prolonged almost indefinitely; though

besides the uræmic symptoms of coma and convulsions, various complications, such as bronchitis, pericarditis, endocarditis, pleurisy, pneumonia, peritonitis, gastritis, and ulceration of the intestines, may occur with unfavorable results. Some of these are less frequent than in diffused disease of the kidney, still they are liable to occur from the poisoning of the blood by retention of excrementitious substances. *Post mortem* the kidneys are found smaller than in health, and often less than half the size. They have an uneven granular surface, which, however, may not be recognized until after the capsule is removed. Cysts varying much in size, and filled with a watery or gelatinous material, are generally present. The capsule is thickened and adherent, its vessels dilated, and the lymph spaces enlarged. The body of the kidney is granular, hard, tough, and commonly darkened in color. Hence it has been called the "red granular kidney." The reduction in size is mostly due to a narrowing of the cortex, though the medulla is contracted to some extent. Fat is usually accumulated around the contracted kidneys, even if the patient be emaciated.

The changes are due to hyperplasia and contraction of the connective tissue. Some of the tubules are normal, while others are dilated and some show the epithelial cells granular and degenerated. The cysts are dilated uriniferous tubules, and sometimes dilated Malpighian capsules.

The *vessels* of the kidneys are compressed, and part of them destroyed. Some are dilated and twisted. The essential change in the vessels, Dr. George Johnson insists, is "the thickening of the tunica intima, or the hypertrophied renal arterioles," which obstructs the circulation through them and reacts upon the left ventricle of the heart.

It has lately been pointed out that certain changes occur in the nervous renal ganglia, consisting in a hyperplasia of the connective tissue and fatty degeneration of nerve cells. (Drs. Da Costa and Longstreth.) They think this change in the nerves is primary, and the cause of the renal changes.

Retinal changes are frequent in this form of disease, but they do not materially differ from those already mentioned.

The *diagnosis* of this form of Bright's disease is made by examining the urine and observing the symptoms. In a well-marked case the urine is not diminished in quantity, is of low specific gravity, has a small amount of albumen, and has delicate hyaline and pale granular casts. There is a feeling of uneasiness, slight swelling of the feet, drowsiness, intense headache, confused intellect, dyspeptic symptoms, obstinate nausea, delirium, coma, and convulsions. The latter symptoms, as has already been stated, are often long delayed, and the

patient may be cut off by intercurrent diseases without their ever appearing.

TREATMENT OF CHRONIC BRIGHT'S DISEASE, CHRONIC DIFFUSED NEPHRITIS, CHRONIC INTERSTITIAL NEPHRITIS.

The treatment of this affection will be varied by the particular form and stage of the disease, and the symptoms and complications which are present. Two general indications present themselves. First, to arrest, retard, or favorably modify the pathological condition of the kidneys, and, second, to avert and relieve the effects of their diseased state, and enable the system to endure them.

Some writers regard the fulfillment of the first indication as an impossibility, and it is sad to know how much ground there is for that belief. Still, when the disease is early detected I believe something, and in some cases much, may be done, if not often to arrest, yet to retard and favorably modify the morbid process.

When the disease is thoroughly established and structural changes are far advanced, there is little or no ground of hope for their complete removal. But even then the progress of the changes may be much retarded, and the general condition may, for a time at least, be much improved. Several cases have occurred in my experience where the evidences of the early stages of the chronic, insidious disease were present—where albumen was present in considerable abundance, where casts were found and slight œdematous conditions were observed, where depression and debility were apparent, but where, after a protracted effort, the albumen disappeared and apparent health was regained. At the present writing one lady has been under my observation for more than four years, who when first seen had been suffering from ill health for many months. Her skin was pale and waxy, her heart was moderately hypertrophied, but without valvular lesions, the lower extremities were markedly œdematous, the urine was heavily loaded with albumen, and epithelial and granular casts were found. Since that time she has been under a continued course of treatment, and a few weeks ago the urine, when examined, was found for the first time with scarcely a trace of albumen, without casts, and nearly normal in amount and in specific gravity. In another case, more than two years under my observation, there had been general failure of health for some months previously, retinitis had occurred with marked impairment of vision, and albumen and casts were in the urine. Under treatment the vision improved greatly, and according to the last report the albumen had been reduced to a mere trace, and casts were no longer found.

More than twenty years ago, a young medical practitioner, who had

been much exposed in a laborious country practice, had noticed failing health for some months, pain in the loins, and albumen and casts in the urine. He was advised to suspend his business; and by rest, care, a regulated diet, and other treatment, in six months the albumen and casts disappeared, his health was restored, and he is now, and has for years been entirely free from any symptoms of his former disease.

Cases of the kind referred to have become too numerous to allow us to abandon all hope of curing Bright's disease. It is now generally admitted that the progress of the disease may be much retarded by proper treatment; and the bearing of these facts in mind gives encouragement for persevering efforts for relief and cure.

In commencing treatment, the cause should first receive attention, and if it still continues, every effort should be made for its removal. If alcohol is used, it should be discontinued. Exposure to wet and cold must be avoided. Strict hygienic regulations should be observed. A warm, equable climate is best. Free action of the skin should be promoted by baths, friction, and proper clothing. Proper dietetic regulations are of much importance. The food most digestible and best adapted to the case should be carefully selected. All substances that impose greater task upon the kidneys or irritate those organs should be avoided. By all means the bowels should be kept open, and all the natural functions of the body should be promoted and its forces conserved. These general measures are suggested on obvious principles and are of much importance.

But particular therapeutical measures may also be of much service.

With reference to arresting or materially modifying the pathological state of the kidneys, the earlier stages of the disease are by far the most favorable. The early examination of the urine in cases the least suspicious is of the utmost consequence. The disease of the kidneys is an inflammation, and inflammations are much more influenced by treatment in their earlier stages than later, when more profound structural changes have occurred.

It is true that "the prospects of a patient suffering from confirmed chronic Bright's disease are exceedingly gloomy. Many of the textural changes are of a kind that do not admit of reparation. The Malpighian bodies become enveloped in an exudation of low plastic material, of which the only (?) tendency is to progressive contraction, and the tubuli are either blocked up with fibrinous plugs or shriveled into useless fibres. The gland, however, is not equally affected throughout all its parts, and the less injured portions carry on imperfectly the depurative function." (Roberts.)

It is true that there is a strong tendency to a progressive course in these changes, and when more parts become involved, the work done by the kidneys grows less and less, and the contamination of the blood by retained effete elements becomes greater and greater until a limit is reached incompatible with life.

In most cases, however, death is brought about by complications or by more acute extensions of the kidney disease, which neglect may induce, and care and remedies may avert.

It is not, however, established that progression of the disease is inevitable, or that no repair of any of the morbid conditions can take place. On the contrary, both from analogy and from observed facts, it appears extremely probable, if not proven, that when the disease has not gone too far, morbid processes may sometimes be arrested and repair may take place. Certainly in acute nephritis involving the same tissues, cures are common; and why may not cures occur in the earlier stages of the chronic disease? It seems to me a too exclusively gloomy view is taken in most of our standard works.

The treatment of chronic Bright's disease is a matter of the gravest importance, not only in reference to palliation but to cure. In those cases dependent upon alcoholism, whether from extreme or what is regarded as moderate indulgence (and these cases are very numerous, especially in Great Britain), where there is a general lowering of vitality and perversion of nutrition, the progress of the disease is almost inevitably onward. When the disease arises from other conditions, as from exposure, fatigue, and errors in food, the removal of these causes gives more hope.

The special management of cases requires great care. From the intimate functional relations between the skin and kidneys, the condition of the cutaneous circulation and secretion is a matter of much moment. The surface should be kept warm, and its circulation and secretion active, both because of the effects of cold in producing internal congestion, and because of the aid given to the kidneys by the functional activity of the skin. A patient with Bright's disease should be warmly clad. "Flannel from the neck to the wrists and ankles, or even fleecy hosiery, must be worn in the daytime, and flannel night-dresses must be used for bed-wear." (Fothergill.) Changes of temperature must be followed by changes of clothing, sometimes more than once a day. The clothing of the feet is particularly important. The shoes or boots must be thick and well lined. There should be inner soles of cork, felt, or fur. Rubber shoes should be lined so as not to conduct the heat from the feet too readily, and should be worn only when there is exposure to wet. If worn indoors, or constantly, the retention of perspiration they induce is uncomfortable

and injurious. All damp covering for any part of the body must be changed without delay. "The subject of Bright's disease lives over a volcano; and the slightest carelessness may be followed by the most grave consequences. What would produce a mere cold in others may induce an attack of intercurrent inflammation in them." (Fothergill.) This might result in impairment or destruction of the more healthy portions of the kidneys, with all the consequences of suppressed functions.

While it is thus important to keep the skin in an active condition (and various therapeutical measures may for this purpose be added to the hygienic), it is no less important that the bowels should be kept free. For this purpose laxatives may be required, and such as will promote intestinal secretions as well as peristaltic action. Moderate doses of the salines are often well borne. Acid substances which may pass off from the kidneys should be avoided.

The matter of diet is no less important, both with reference to the morbid condition of the kidneys and the symptoms resulting from it.

As little labor as possible in removing organic matters should be thrown upon the inflamed kidneys. Nitrogenous foods, when taken in any considerable quantity, it is well known, increase the amount of urea and other organic excretions to be eliminated by the kidneys, and thus increase their labor. Besides, when their excreting function is impaired by an abundant nitrogenous diet, uræmia is more likely to occur. There is a necessity, therefore, of limiting the amount of nitrogenous ingesta, both to relieve the kidneys from labor, and the blood and system from the accumulation of urea and other azotized effete materials. As the secreting capacity of the kidneys is diminished, the amount of azotized foods should be diminished. Nitrogenous food may give a sense of energy, but at the expense of increasing the disease of the kidneys and causing danger of uræmic poisoning. Farinaceous foods will supply all the absolute needs of the system, and only very moderate quantities of meats should be allowed. Various unirritating fruits are unobjectionable and are advisable.

An almost or quite exclusive milk diet has been strongly advised in this disease, and although milk contains a considerable quantity of nitrogenous material, the system is not likely to obtain an excess from it, and it has other properties, apparently therapeutic in these cases, which render it well adapted to them. It operates as a gentle diuretic without being an irritant to the kidneys, and its beneficial effects seem well attested by experience. In the use of an exclusive, or nearly exclusive, milk diet there is generally a decrease of the albuminuria, a decline in the dropsy when it is present, increase in the quantity of urine passed, and general amelioration of the symptoms. Some

patients can be well sustained on milk alone, when from two to three and a half quarts may be taken in the twenty-four hours. With some a portion of farinaceous food seems demanded, but then the diet should be as largely as possible composed of milk. Where the milk is entirely relied upon, it should be taken once in a few hours, with regularity, during the day.

Rest is often an important element in the management of a case. When the disease is at all active there should be rest in bed; and in all cases fatigue should be avoided.

The beneficial effects of fresh air and sunshine should not be overlooked, and carriage riding in pleasant weather, with good protection as to clothing, should be encouraged.

The use of diaphoretics in chronic Bright's disease has been intimated, and they may serve a useful purpose not only in eliminating water, salts, urea, and other organic matters from the blood and system, but also in deriving from the kidneys and diminishing their irritation and inflammation. Their use in acute nephritis has been dwelt upon, and in chronic cases the same general principles apply. They cannot, however, be used as actively for a lengthened period as was recommended in the acute cases. The warm bath, the warm-pack bath, and the hot-air or Turkish bath are often very useful accessory measures, and should be made available when practicable. The relief obtained by these means, especially by the hot-air bath, is often marked and decided. Sometimes, however, the hot-air bath does not produce perspiration, but the head and face become flushed, and headache and other unpleasant effects result. A wet napkin applied to the head while the hot air is used will sometimes prevent the unpleasant symptoms; but if not, the water bath or the pack should be substituted.

Of the internal diaphoretics the *jaborandi* or its derivative is by far the most efficient, and may be resorted to from time to time as may be borne, and as will not interfere with the means for fulfilling other indications. When the article is repeated every second day, more or less frequently, and alternated with the baths, its utility in many cases cannot be questioned. It is, however, more particularly indicated where the symptoms are more acute.

Cathartic remedies divert from the kidneys, eliminate from the blood, and tend to the relief of the diseased process. They are, however, more particularly indicated for depurative purposes and for relieving the dropsy, and the manner of their use for these purposes will soon be referred to.

Besides these principles of treatment, which must commend themselves as rational, and which are certainly important, there are vari-

ous special remedies which have been used for the purpose of arresting or modifying the diseased process in the kidneys.

Mercury has been advised for that purpose, and some years ago *corrosive sublimate* in small but long-continued doses was a favorite remedy with some. The use of this agent, when not carried to the extent of producing its spanæmic effects, but rather to improve, as it sometimes does, the quality of the blood, is doubtless sometimes markedly beneficial. In chronic retinitis the ophthalmologists insist upon its use, and it may do good in some cases of Bright's disease; but it has not sustained the reputation it once had in certain localities, and there are few now who urge its use. Any form of mercury carried to the extent of producing its spanæmic effects, and those effects in some cases are readily produced, cannot fail to do great mischief. One case came under my observation where severe salivation and sphacelation of the gums, followed by great prostration and speedy death, were induced by the administration of corrosive sublimate by a professed homœopathic practitioner.

Analogy has suggested the use, and my own experience has established in my mind a belief in the propriety of the long-continued use, of *iodide of potassium*, commenced early in the disease, and persevered with in such doses as may be borne. The cases of improvement referred to on a preceding page were treated with this remedy, as well as other concomitant measures, but I cannot doubt that the iodide produced a decidedly beneficial effect. This opinion has been strengthened by other experiences; and I cannot too strongly advise its trial where the system bears well, as it generally does, its protracted use. From four to eight grains, well diluted, three times a day, have usually been prescribed, and its use has been continued not only for a few months but for a few years. The lady before referred to has now been taking the remedy, with only occasional interruptions, for nearly four years, with the effects there described. The case is a complicated one, and the question of complete recovery is yet to be determined. Bartels advises it in quantities of from twenty to thirty grains daily for an indefinite period, and has seen no prejudicial effects from its uninterrupted use for many months.

Tannic acid, *gallic acid*, *ergot*, *eucalyptus globulus*, oil of sandalwood, fuchsin, rosaniline, and some other articles, have been used with reference to specific effects. I can speak of neither of these articles from experience, and they have not obtained the confidence of the profession as curative agents. In a disease so severe and obstinate, any remedy for which success is claimed by competent observers should receive attention. The last two articles are reported from abroad to have the effect of causing the albumen to disappear from

the urine, and are said to be comparatively harmless and well borne by the organism. The dose of fuchsin is from seven to thirty-eight grains in the twenty-four hours.

The second indication, that of averting and relieving the effects of the disease of the kidneys, and enabling the system to endure these effects, is fulfilled by some of the same remedies, the use of which has been described.

For the retained urea cathartics and diaphoretics are the chief remedies. They are also the chief remedies for relieving the system of the dropsical accumulations. The cathartics most efficient for both these purposes are those which excite the most free secretions from the intestinal membrane. The salines, the compound jalap powder, and especially elaterium, produce the freest secretion, and are the articles most frequently prescribed. There is, however, a limit to their use, since they not unfrequently reduce the strength much more rapidly than the dropsical accumulations, and they may fail to eliminate urea or avert uræmic poisoning. They, however, have their uses, and are often important remedies, but must be used with discretion and their effects must be carefully observed, regard being paid to their possibly injurious as well as beneficial action.

They may sometimes be repeated daily, or every second or third day, and in such free doses as the strength will bear. Elaterium as found in shops varies in strength, and in commencing the use of an article not before tested the minimum dose should be given, to be increased and repeated according to the effect. From one eighth to one half a grain or more will be a proper cathartic dose. Given very early in the morning its cathartic effect may be over, so that a breakfast may be taken by eleven o'clock. Details, however, must be left to the judgment of the physician in each particular case. The dose of other cathartics must be regulated on the same principles.

Of diaphoretics, as already stated, the jaborandi or pilocarpin is most efficient. From one quarter to one third of a grain of the *muriate of pilocarpin* may be given hypodermically, dissolved in a proper quantity of water. This may be alternated with the baths already described.

Should marked uræmic symptoms appear, these eliminative remedies must be pushed with vigor, and the other measures already spoken of must be used.

Diuretics may be added to the other measures whenever the kidneys are supposed to be in a condition to respond to their action, and are not so acutely inflamed as to be unduly irritated by them. *Digitalis* and bitartrate of potash are the articles chiefly to be used. The latter

operates both as a diuretic and cathartic, and the former operates upon the heart as before described.

Asparagus and water-melons produce a diuretic effect, and usually without irritating the kidneys, and may be used in their season.

The improvement of the condition of the blood may require iron and other tonics. The muriated tincture of iron is often prescribed in doses of from ten to fifteen or twenty drops three times a day; and in addition to its beneficial effect upon the blood and the general system, it is thought sometimes by an alterative effect to improve the condition of the kidneys.

Dyspeptic symptoms are often present, requiring attention. They should be treated according to their character, and on the same principles as other cases of dyspepsia. Pepsin, dilute hydrochloric acid, strychnine, quinine, and bismuth are among the remedies to be thought of, and from which selections are to be made.

Diarrhœa is generally useful, eliminating water and urica, and should be interfered with only when excessive, and when rapidly and alarmingly exhausting the strength. Astringents may then be used with moderate doses of opiates. Other complications, such as bronchitis, pneumonia, pulmonary œdema, etc., must receive prompt attention, as they are the most frequent immediate causes of death. The reader is referred to the account of these various affections for directions as to the manner of dealing with them.

There are various compound prescriptions which in the course of chronic Bright's disease have been advised by different practitioners. The following are given as examples, and the indications they are intended to fulfill will be readily seen.

℞ Tinet. Ferri Chlorid.....	3 ij
Liq. Ammoni. Acetatis.....	3 ii j
Syrupi Simplicis,	
Aquæ.....	āā q. s. ad 3 v j

M.—Sig. Table-spoonful three times a day in half tumbler of water.
(Bashaw.)

℞ Liq. Ammoni. Acetatis.....	3 ij
Spts. Nit. Dulc.....	3 ss—j
Oxymel Scillæ.....	3 ss
Aquæ Camph.,	
Aquæ.....	āā 3 x

M.—Sig. A dose three times a day.

It should perhaps be more particularly stated that many cases of

Bright's disease cannot be regarded as belonging strictly and exclusively to either of the varieties mentioned. At different stages of a given case, different anatomical elements may be involved and in a different manner. There may be in the same case different degrees and stages of inflammatory action, with different results, not only in the different kidneys, but at different parts of the same kidney; and different forms of degenerative change may also be found in the same patient at the same time.

It will therefore be difficult or impossible to make, in some instances, an exact diagnosis of the pathological state. Nor is this essential. The principles of treatment in the different forms are much the same, and the details are largely influenced by the particular symptoms which present themselves.

Fatty degeneration of the kidneys is not regarded as a form of Bright's disease. Fatty changes may follow an inflammation, but when they occur as an idiopathic condition they are usually associated with a similar change in other organs, and will require the general supporting measures applicable to other cases. It will be suspected when there are the usual evidences of fatty degeneration, and when the function of the kidneys is specially impaired. Uræmia and dropsy may result in other diseases of these organs.

ANURIA.

From what has preceded it will be observed that urinary insufficiency with the symptoms of uræmia may arise from a variety of causes. Any disease of the kidney which prevents secretion may result in retention in the blood of the waste products of nutrition; or any mechanical obstruction to excretion in the ureters, the bladder, or the urethra, may be followed by reabsorption of the urinous elements, often changed in composition by chemical processes, producing effects similar to those caused by suppression of the secretion. Urine long retained in the pelvis of the kidneys, the ureters, or the bladder, usually undergoes decomposition with the production of carbonate of ammonia. This produces irritation of the parts with which it is in contact, and it is absorbed with other results of chemical or putrefactive changes, and poisons the system.

Symptoms of what is termed uræmia may be caused by the absorption of carbonate of ammonia and other products; by non-elimination of urea and extractive substances; by effusion in the ventricles of the brain, and by œdema and consequent anæmia of the cerebral substance.

Which of these has most to do in the production of the phenomena of uræmia is not certain. There are wide differences of opinion on the subject, but either or all may be concerned in different cases.

The symptoms of uræmia may come on rapidly or slowly. In the rapid cases and those that become extreme, convulsions and coma, alone or variously combined, are present. In the more gradual forms, or where there is a less intense degree of poisoning, a variety of symptoms are produced which have already been alluded to or described.

The treatment of blood poisoning from reabsorption of urinary excreta is essentially the same as for that resulting from failure of secretion.

The removal of the retained urine is of course essential; but that pertains to surgery.

TRANSIENT OR TEMPORARY ALBUMINURIA.— “HÆMATOGENIC ALBUMINURIA.”

Before dismissing the subject of albumen in the urine, a brief account of its transient appearance seems required. The term hæmatogenic, proposed by Prof. Bamberger of Vienna, indicates that the cause of the passage of the albumen into the urine is in the blood rather than in the structure of the kidney. This *functional* albuminuria, as it is sometimes called, is often trifling in amount, presenting only a trace when the tests are applied, but in other cases the amount is considerable. It sometimes occurs in persons in apparent health; and also in febrile states, but when there is no evidence of structural disease of the kidney. In passive congestions and in epileptic attacks it sometimes appears, and also in convulsions from strychnine poisoning.

Why albumen, as it is in a state of complete solution in the blood, does not habitually pass with the urine it is not easy to say; and until that question is answered it is difficult to say why it passes in certain morbid or exceptional conditions. We know that the blood-albumen does not ordinarily pass out in secretion, but that egg-albumen when injected into the vessels does pass out, and this suggests that the cause of the passage, sometimes at least, may depend upon the conditions of the albumen in the blood. The passage is believed not to depend upon the tenseness of the pressure of the blood, but more upon the slowness of its motion in the kidneys. But the ultimate reason for the passage or non-passage of the albumen is a matter of speculation and conjecture rather than of demonstration.

It is quite possible that in cases of transient albuminuria more

depends upon the changed condition of the structure of the kidneys and less upon changes of the blood or the action of the vessels than is generally supposed.

The appearance of albumen in individuals, in apparently perfect health, and where it might therefore be supposed to be functional, has been proved afterward to be organic, by the patient not long after having a full and fatal development of Bright's disease.

A case of this kind occurred in a student in the class of urine analysis in the University of Michigan. While in apparently full health, on examination of his own urine, which was supposed to be a healthy specimen, he found it to contain a considerable amount of albumen. He was feeling well, and could not be persuaded that he was otherwise. He continued many weeks under observation without any symptoms of disease being discovered, other than the single one of albumen in the urine; but in less than six months after he passed from under our observation, at the close of the college year, he died of Bright's disease.

The inference drawn from my observations is, that in every case of albumen in the urine, however free from other symptoms the patient may be, disease of the kidney should be suspected, if not positively inferred, and treatment should be instituted to avert the impending calamity.

The removal of the symptom should not be regarded as an evidence that no structural disease had existed. I have confidence in the power of early and proper treatment in Bright's disease to remove, in some cases, the albuminuria and its cause.

SUPPURATIVE INFLAMMATION OF THE KIDNEYS.

—PYELITIS.

Pyelitis is an inflammation of the mucous surface of the pelvis of the kidneys. It may be acute, running a comparatively rapid course to recovery; or the inflammation may become chronic. Pyelitis may be produced by wounds penetrating the part, by calculi lodged in the renal pelvis; by entozoa—especially by the *strongylus gigas*, and by hydatids; or by obstruction of the urinary passages, leading to accumulations, in the pelvis and calices, of urine, which undergoes decomposition and acts as a local irritant. This obstruction may be due to calculi or growth in the ureters, to pressure upon them, to paralysis of the bladder, to enlarged prostate, to stricture of the urethra, etc. In some cases of cystitis, the inflammation extends to the pelvis of the kidney; and it is thought that bacteria, obtaining access to the bladder,

as is apt to be the case by the use of uncleaned catheters, may make their way to the kidneys, even to the uriniferous tubes, and give rise to pyelo-nephritis. Pyelitis sometimes occurs in connection with some infectious diseases; and fibrinous exudations instead of purulent effusions may take place.

The Anatomical Characters of pyelitis will be readily understood. The ordinary appearances of inflammation of a free surface will be present. The inflammation, however, very often extends to the parenchyma of the kidney, producing pyelo-nephritis. The extension during life is not always distinguishable; but on *post-mortem* inspection, hyperæmia, exudations, and sometimes suppuration will be found in the body of the kidney. Not unfrequently inflammation of the bladder and the urinary passages will also be present at the same time. Sometimes a diphtheritic membrane will be found on the mucous surface, and calculi may not unfrequently be discovered; and it is alleged that colonies of bacteria are sometimes observed.

In pyelitis, according to the extent and acuteness of the disease, there will be pain in the lumbar region, and febrile symptoms more or less marked. The pain, however, is not usually severe, and is sometimes absent entirely.

When calculi are present, the pain is likely to be more decided, and when they pass the ureters it is often very violent. The most characteristic symptom and most positive evidence of the disease is the presence of pus, and often of blood, in the urine, and of *epithelial cells* having the character of those of the renal pelvis. They are not, however, always distinguishable from those of the bladder.

The urine is often increased in quantity, though if the ureters be obstructed it may be deficient. The suffering then will be greater, and a dull, painful sense of distention may be experienced.

The Diagnosis is to be made by examining the urine and observing the symptoms mentioned, excluding cystitis and urethritis, which are frequent sources of urinary pus, mucus, and blood. In complications where other parts than the pelvis of the kidneys are involved, the diagnosis may be obscured; but a careful consideration of all the facts in the case will enable the careful practitioner to make a probable, if not a positive, diagnosis.

INTERSTITIAL SUPPURATIVE NEPHRITIS.

Acute suppurative nephritis is so frequently associated with pyelitis, that they may be discussed together, at least in some of their features. Large collections of pus in the kidneys are not frequent, but they sometimes occur, presenting the phenomena of deep-seated abscesses—

pain, tenderness, often perceptible swelling, fever often taking a hectic form—and derangements of the urinary secretion.

Small purulent foci are more frequent, and are generally due to the presence in the kidney of some infectious agent exciting the suppuration.

These cases occur oftenest in connection with wounds, or after operations, or when there is suppuration elsewhere in the system; they are pyæmic, and are attended with the symptoms of general pyæmia. In many of these cases, it is alleged that colonies of sphærobacteria or micrococci have been found in the kidneys, and are supposed to have excited the suppuration.

In the pyæmic or septicæmic cases, in addition to the bacteria, emboli and the common causes of secondary abscesses are concerned in the production of the effect.

Anatomically, acute interstitial suppurative nephritis presents a swollen condition of both kidneys. Yellowish-white elevated spots, surrounded by hemorrhagic zones, are seen when the capsule is removed, when the disease is much advanced. These points are first decolorized and then become purulent. Their size varies from that of a pea to that of an almond, and larger; and sometimes, by a coalescence of several, a larger putrid or purulent mass may occupy a considerable portion of the kidney. Abscesses, the result of bacteria, are said at their early stage to present a necrotic mass, followed by a more free suppurative process.

An abscess of long standing may be surrounded by a membrane and undergo a caseo-cretaeous transformation. An abscess may extend beyond the bounds of the kidney and in various directions. The pus may be evacuated into the peritoneum, the intestines, or the lungs, or the abscess may point externally. In many cases, however, the pus is evacuated into the pelvis of the kidney, and is discharged with the urine. In these cases opportunities for post-mortem examination are less likely to be afforded. The disease may be confined to a single kidney, and when this is the case, the other may sufficiently depurate the blood. It is seldom, however, when one is diseased in this manner, that the other is found in an entirely healthy state.

Symptoms.—The miliary abscesses which form in the kidney from pyæmia give rise to no marked local symptoms, and the general symptoms are those of the general pyæmic state.

Acute interstitial suppurative nephritis has a striking onset. The pain in the loins is severe, sometimes even more so than that of small-pox. There are repeated chills, irregular fever, often delirium, somnolence, or coma. The urine is commonly diminished in quantity, is high colored, and sometimes ammoniacal. It may be albuminous

and contain casts, but generally the albumen is from the blood which is in it.

Contrary to what occurs in most febrile and inflammatory attacks, the specific gravity of the urine is not high, owing to the diminished power of the kidney to eliminate solid materials.

The irritation is apt to extend to the bladder, when a frequent desire to micturate is produced, while a very small quantity of urine is passed; and sometimes there is a complete suppression of the secretion. This may be temporary, though there is danger of uræmic symptoms.

The pain, which is decided, unless a comatose condition is present, is increased by pressure and by movement, and vomiting is not an unfrequent symptom.

A low febrile condition is apt to come on, assuming a typhoidal or hectic character, and the patient may succumb after a more or less protracted struggle. If the bladder or prostate be affected, poisoning by the absorption of the decomposing urine may occur, unless the urine is drawn off and the bladder washed out.

Suppurative nephritis, following operations upon the perinæum or pelvic organs, is often rapid in its course, and sometimes proves fatal in a few days.

In a decided attack the Prognosis is grave, though patients frequently recover. When only small abscesses are formed, the pus may undergo granular and fatty degeneration and be absorbed away. A discharge of an abscess into the pelvis of the kidney may result favorably. In pyæmic cases death usually results, and those arising from operations in the pelvic region are very dangerous. When an abscess is of considerable size and becomes chronic, although recovery sometimes takes place, the patient is apt to be worn out by hectic fever and exhaustion. When both kidneys are seriously involved there is great danger from uræmia. In the aged, the paralytic, and those having diseases of the bladder, the prostate, or the urethra, the danger is greater, and the progress is more rapid.

A Differential Diagnosis is to be made by carefully observing the symptoms which have been detailed.

Small abscesses, due to pyæmia, have no diagnostic symptoms. Cases of traumatic origin are distinguished by the local pain and the constitutional suffering. When it is connected with pyelitis, the early appearance of pus in the urine, with blood and epithelium, will be indicative of that complication; and when there are renal calculi, the occurrence of renal colic as fragments pass the ureters, and the appearance of gravel in the urine will be evidence of this state.

A sudden and free discharge of pus with the urine, together with

the preceding history, would be diagnostic of an abscess rupturing through into the pelvis of the kidney.

A large renal abscess might be detected by a fluctuating tumor in the region, provided a perinephritic abscess be excluded, and also collections of urine or pus in the pelvis of the kidney from obstruction in the urinary passages.

Treatment.—The treatment of suppurative inflammation of the kidneys will be influenced by its causes, its acuteness or chronicity, its complicating conditions, and the general state of the system.

In an acute idiopathic case arising from taking cold, with the active symptoms described, in a vigorous or robust patient, blood should be taken from the arm, followed, as may be indicated, by wet cupping from the loins. A saline cathartic should be given, and after its operation the system might be brought, as in other visceral inflammations, under the full antipyretic and antiphlogistic influence of morphine and quinine. Should these agents fail to reduce the heat and other inflammatory symptoms, and to produce perspiration, a full diaphoretic dose of jaborandi or pilocarpin might be given, repeated as required or as can be borne; and the effects of these remedies might be aided by the judicious use of the cold or warm bath, or by local packs, fomentations, or poultices to the loins.

Some would prefer aconite, veratrum viride, or tartar emetic, and the choice of particular agents may be allowed; but a general antiphlogistic and antipyretic course will be demanded.

When the suppurative process of the kidneys is suspected as the result of general pyæmia, the treatment would not be materially different from that required for the pyæmic state.

When the symptoms are the result of traumatism, and are acute, the same general course should be pursued as in primary cases, though perhaps less depleting measures will be called for.

In feeble conditions of the system depletion will not be as well borne; but the bowels must be opened, while the quinine and morphine are chiefly to be relied upon, aided by dry cupping, baths, packs, or fomentations.

When the case becomes chronic, depleting remedies will no longer be called for, but rather soothing and supporting measures. The bladder must receive proper attention, large or long-continued accumulations of urine must not be allowed to take place, and should uræmic symptoms occur, they are to be treated as in uræmic poisoning from other causes.

Should a large abscess form, detected by the appearance of a tumor and by fluctuation, aspiration might be practiced, or a freer opening made after exploration, as in abscess of the liver. The case then

is to be conducted on general principles, as in other abscesses of deep parts. Tonics—iron, quinine, codliver oil, etc.—may be required. The diet and proper hygiene, as in all other cases, should receive attention, and should be adapted to the conditions of the system. Milk, as a rule, should be a staple article of food. Rest is important; but in protracted cases fresh air and sunlight will be demanded.

PERINEPHRITIS.—PERINEPHRITIC ABSCESS.—PHLEGMONOUS PERINEPHRITIS.

Inflammation of the cellular and adipose tissue around the kidney occasionally occurs, sometimes resulting in adhesive or fibrinous exudations and an increase of connective tissue, which produces a hard swelling, and may result in suppuration.

Phlegmonous perinephritis may be primary, due to taking cold, or to the more obscure causes of local inflammation. The disease is oftener secondary, and is due to traumatic injuries, violent exertion, disease of neighboring organs—especially to diseases of the kidneys—pyelitis, suppurative nephritis, urinary infiltration, renal calculi, hydatid cysts, and renal tubercle.

It may also be secondary to cystitis, inflammation of the liver and gall-bladder, of the spleen, or of the cellular tissue of the pelvis. It sometimes accompanies the puerperal state, typhus and typhoid fevers, and it has been known in variola.

The adhesive form of inflammation in this situation has no distinctive clinical history, and does not require special notice. Suppurative perinephritis is not a frequent affection, but it has some characteristics and relations which require a brief notice.

Such abscesses vary in size, their walls may be shreddy and necrotic, or firm and well-organized fibrous tissue. They travel in different directions, but in a majority of cases extend backward and come to the surface in the lumbar region. The pus may, however, travel downward, and point below Poupart's ligament, or upward to the diaphragm, and penetrate to the lungs and be discharged by the bronchi or into the cavity of the chest. It may pass behind the peritoneum into the pelvis, may be discharged into the colon or other parts of the intestines, or into the bladder, and sometimes it makes its way to other parts. It is sometimes discharged into the pelvis of the kidney. The pus, as in other abscesses, varies in quality—is sometimes laudable, sometimes shreddy and necrotic, and sometimes thin and watery.

It resembles in character the abscesses about the cæcum, but is often connected with kidney diseases—with renal calculi or abscesses

—and in an attempted diagnosis it may be confounded with diseases of the kidney itself.

The Symptoms attending such an abscess can readily be imagined. There will be pain and tenderness in the region, more or less feverishness according to the acuteness of the case, and the general suffering of the system will be like that in other deep abscesses. In acute cases the patient is confined to the bed with his limbs flexed; and sooner or later a swelling, or a more or less distinct and circumscribed tumor may be felt. Fluctuation, though sometimes obscure and uncertain, may often, sooner or later, be felt, and the course of the abscess may be traced as it travels in different directions.

It is to be distinguished from abscess of the kidney itself by there being less disturbance of the functions of these organs; by the urine not being materially changed in quantity or character; by the absence of albumen, pus, blood, and casts, and by the general system being usually less affected.

The *Treatment* should be conducted on the same principles as that for abscesses about the head of the colon. To the account of these abscesses the reader is referred. By early treatment in perinephritic, as in perityphlitic abscess, or rather in inflammations which tend to the production of such abscesses, resolution may often be induced. As soon as the existence of pus is suspected the tumor should be explored, and when the presence of pus is thus demonstrated, the abscess should be opened to prevent its passing off in unfavorable directions. Under proper treatment recovery usually takes place and is complete. When the psoas muscle is involved, lameness may result, and when the abscess is allowed to travel off in untoward directions, serious consequences may follow.

HYDRONEPHROSIS.—DROPSY OF THE KIDNEY.

When obstruction takes place in the urinary passages, particularly in the ureters, an accumulation of urine occurs in the pelvis and calices of the kidneys, and, if long continued, dilatation of the cavity and renal atrophy result. According to the situation of the obstruction, the dilatation may involve other parts than the cavity of the kidney, and we may have something more than simple hydronephrosis, or dropsy of the kidney alone. Sometimes the cyst is single, at others there are septa, which give it a lobular appearance, the calices forming these separate lobuli, but opening into the main cavity of the pelvis of the kidney by wide mouths.

The liquid usually has the appearance of pale urine, but may con-

tain pus, epithelium, and blood. Sometimes the liquid is largely albuminous, or has a gelatinous appearance.

The ureters may be enormously distended, as well as the kidney, presenting the appearance of coils of intestine.

When such a collection of large dimensions exists, it is only on one side, as where there are obstructions in the urethra or bladder which would affect both sides, unless soon relieved, death would be the result.

Hydronephrosis is sometimes congenital from various malformations, at other times the condition is acquired from disease of the parts.

The acquired cases may be from impaction of calculi, the most common; from disease of the walls of the ureters, pressure upon the ureters from without, from tumors, inflammatory products, etc.; diseases of the bladder, involving the orifices of the ureters, thickening of its coats at those points; and finally, strictures and injuries of the urethra, and enlargement of the prostate. It is said that in some cases the *post-mortem* examination has failed to reveal the cause.

When the hydronephrosis is unilateral, but few symptoms may be produced. One kidney may sufficiently deplete the blood when pressure has obliterated the secreting capacity of the other. When both are affected, the case is grave, and uræmia is likely to occur, and must soon be fatal when the anuria is complete. When the accumulation is great, a tumor can be felt, and if on the removal of the obstruction a large quantity of urine passes with the disappearance of the tumor, the diagnosis would be readily made. In some cases the obstruction is incomplete, and the tumor fluctuates in size. This would be diagnostic. These tumors are not usually painful; they may, however, cause pain by pressure on other parts, and renal colic not unfrequently precedes or accompanies this condition.

Small hydronephrotic sacs are not discoverable. Very large ones, filling a considerable portion of the abdomen, as is sometimes the case, may readily be mistaken in the female for ovarian cysts, or in either sex for ascites. A full history of the commencement of the enlargement, its position and the accompanying symptoms, will aid the diagnosis. It is, however, not always easy to make a diagnosis of one of these cases. The colon may lie over the collection and give a tympanitic resonance. This may render obscure the presence of a cyst, but would generally exclude an ovarian tumor. The colon is seldom in front of an ovarian tumor.

Hydronephrosis might be confounded with a collection of pus in the pelvis of the kidney (pyonephrosis), and an exploratory puncture might be required to determine the character of the fluid. Hy-

datids, a large renal cyst, and a perinephritic abscess must be excluded.

The *prognosis* is generally favorable when only one kidney is affected. When the other kidney is involved in this or any other serious affection, so as to interfere with its eliminative function, the danger at once becomes great. A hydronephrotic sac seldom ruptures, and there is little danger from that source.

Treatment.—The first object of treatment is to overcome the obstruction which has caused the difficulty. When this is in the urethra or the prostate gland, this object may often be effected by proper surgical means. When in the ureters, this becomes difficult or impossible. In some instances manipulations—rubbing and kneading the part—may cause a flow. Much force should not be used, as rupture might be produced. The chief remedy is aspiration. This can be done with little or no danger of the fluid passing into the peritoneal cavity, or of exciting inflammation. The operation may be repeated as required, and other palliative means may be called for, such as particular symptoms indicate.

RENAL CALCULI, OR NEPHRO-LITHIASIS AND RENAL COLIC.

Lithiasis, or gravel, the formation of urinary calculi, is of not unfrequent occurrence. The general subject belongs, however, more particularly to the department of surgery, especially that of stone in the bladder, and this latter, with all the mechanical means of treatment, will be entirely passed over. Concretions within the renal cavities are so far removed from surgical measures, and are so intimately connected with other kidney diseases, that they require a brief mention.

Calculi of small size may pass from the kidneys through the ureters to the bladder, and be carried off in the urine with little or no inconvenience. When remaining long in any situation they are apt to increase by accretions and produce distress and various grave consequences. When remaining in the pelvis of the kidneys they often produce severe pyelitis and other results, as we have seen. When they lodge in the ureters, and cause obstruction, hydronephrosis follows. When calculi of considerable size or with sharp angles pass through the ureters, they give rise to very severe pain of a spasmodic character, extending to the thighs, and the external urinary and sexual organs, with frequent and painful desire to micturate, and often with great general depression. These attacks are called *renal colic*. Similar attacks of severe pain are sometimes caused by the passage of

firm coagula or of hydatids. Sometimes inflammation is induced by the excess of irritation, and complicated cases thus result.

In an ordinary attack of renal colic the pain comes on suddenly; its severity remits from time to time, but when most severe the patient cries out and writhes with tearing or cutting pain, chiefly in the region of the ureter on one side, but radiating in different directions, often to the testicle in the male, which is often drawn up; there is tenesmus of the bladder, the urine is often bloody, and in pyclitic or cystitic complications there is apt to be pus. There are often nausea and vomiting from reflex irritation; depression of the circulation, and a facial expression of great anguish.

After a duration varying in different cases from a few hours to two or three days, the paroxysm often ends very suddenly, leaving only some feeling of soreness, and sometimes not even that. The relief may be sudden and complete. In such cases the calculus has passed into the bladder, and is likely to be passed afterward in the urine. In other cases the relief is not complete—there may be more than one calculus, or the complete passage may not take place, and the pain may linger or be renewed. Sometimes inflammation and ulceration take place at the point of the calculus, which may be impacted, and fatal peritonitis may follow from the escape of urine into the abdominal cavity.

Renal colic is distinguished from other forms of colic by the locality of the pain, the irritation of the bladder and urino-genital organs, and often by the previous history of the case. It should be distinguished from lumbago, in which the pain is more in the back, from neuralgia, and from hepatic colic, neither of which presents the peculiar phenomena of renal colic.

Treatment.—This must consist of palliative measures, and of means for relaxing spasmodic action, which may favor the passage of the calculus. The administration of anodynes is the chief method of relief. Morphine used hypodermically is most to be relied upon, and free doses are generally required to overcome such severe pain. The inhalation of ether or chloroform will be more speedy, but is apt to be transient, requiring repeated renewal. The warm bath and fomentations may aid the effects of the anodynes. The free drinking of water is generally advised.

LITHIASIS.

When concretions are discharged in the urine, with or without pain, the term *gravel*, or lithiasis, is applied. The composition of such concretions differs in different cases. In a majority of instances they

consist of uric acid. They may, however, consist of oxalate of lime, of the phosphates of ammonia and magnesia, and of lime or the carbonate of lime. The ammonio-magnesian phosphates commonly form in the bladder, and often in cases of cystitis, seldom passing through the ureters. Other rare forms of gravelly materials are sometimes observed.

The Treatment of these cases, aside from the attacks of renal colic and the possible inflammatory conditions induced, will consist in drinking freely of water to keep the urine well diluted, and thus to prevent deposits (this is applicable to all the varieties), and in the use of such diet and medicines as will tend to prevent the formation of the materials of which the calculi are composed.

An examination of the urine will determine the tendency or *diathesis* of the system. In case of uric acid gravel, alkalies are generally recommended. The liquor potassæ, in doses of half a drachm, well diluted, thrice a day, is given; but most prefer the bicarbonate or citrate as less injurious to the stomach, and quite as efficient in diminishing the excessive acidity of the urine. These salts may be given in larger quantities than the pure alkali. Alkaline medicines, as a rule, should be given after the process of digestion is over, and in time for their passage from the stomach before another meal is taken. The phosphate of soda in doses of from one to six drachms; the phosphate of soda and ammonia in doses of ten or fifteen grains; and benzoic acid in ten-grain doses are recommended.

The lithia salts are regarded by some as preferable to the salts of potash or ammonia. The carbonate of lithia, in doses of five or six grains, three times a day, is said by Dr. Garrod and others to be particularly useful to combine with uric acid and form a soluble compound. All these are to be regarded as palliative remedies, chiefly or exclusively. The more curative measures consist in such changes in the diet, and such modifications of the digestive and oxidative processes as shall prevent the formation of this excess of crystallizable materials. In the lithic acid condition the diet should consist mainly of milk, eggs, and farinaceous substances, with but little meat. The white meats are least objectionable. Special attention, however, should be given to correcting any morbid condition of the stomach which may be present, and favoring oxidation in the system by fresh air and proper exercise. The skin should receive attention, and all proper hygienic regulations should be observed.

When the concretions are composed of oxalate of lime, or when oxaluria is present without perceptible gravel, the nitro-hydrochloric acid is indicated, to be given in free dilution and after meals. Vegetable acids should be avoided, and proper hygienic regulations enjoined.

When the conerctions consist of the earthy salts the mineral acids are indicated, and a general tonic course is usually demanded.

Nervous asthenia or irritability is generally present when there are deposits of earthy salts and the oxalate of lime, and nerve tonics are often useful. Correcting the conditions of the digestive organs, and enjoining proper hygienic regulations adapted to each case—rest, where labor is excessive; exercise, where it is deficient; change, where monotony is oppressive, etc.—are the most efficient and lasting means of remedying nervous depression.

A course of hydrotherapeia, or of Carlsbad or other saline and depurative waters, will sometimes be found of important service. The methods of these “cures” can often be effectually imitated at the patient’s home.

There are several structural changes of the kidneys which have more pathological than clinical and practical interest, but which require a brief notice.

RENAL CYSTS.

Renal cysts, the results of dilatation of the uriniferous tubes in the contracted kidney, and some other cases of Bright’s disease, have already been mentioned. Sometimes these cysts are very numerous, and they are not always dependent upon Bright’s disease.

Cystic degeneration of the kidney is oftener a congenital affection than one acquired after birth. The cysts are in some cases not only numerous but very large, displacing kidney structure; and sometimes there is an enlargement so great as to interfere with the delivery of a foetus. The causes, pathology, and often the symptoms of these cases are obscure. There is sometimes albumen in the urine and obstructed circulation, causing dilatation or hypertrophy of the heart. Occasionally a cyst is found in a kidney on post-mortem examination, when no symptoms indicated disease of the organ during life.

When a cystic kidney is of sufficient size a tumor may be felt, and the distinction should, if possible, be made between this and other conditions attended by enlargement in the part.

As these cysts are generally multiple, fluctuation will be less distinct than in dropsy of the kidney or in a large abscess, and the preceding history will be different. The needle of an aspirator, or an exploring trocar, might aid in the diagnosis; and thus evacuating the fluid would be a palliative measure.

Echinococci, or hydatids of the kidney, are the same as hydatids of other organs—as the liver or lungs. As a rule, but one kidney is

affected, and if its function be interfered with, its fellow will sufficiently depurate the blood so that uræmia is not likely to occur.

While the hydatid remains within the body of the kidney, very slight and often no symptoms are produced. When it acts as a foreign body, and irritation, inflammation, and ulceration are induced, symptoms appear; and when a cyst opens into the pelvis of the kidney, the echinococci pass into the bladder and are discharged with the urine. When of sufficient size, or when they become impacted in the ureters, they may give rise to renal colic, and after leaving the bladder may obstruct the urethra. They are sometimes passed in the urine in large quantities, and these discharges may be accompanied with blood and pus.

Lodged in the pelvis of the kidney or in the bladder, an echinococcus may serve as the nucleus of a calculus, since any foreign body in these parts favors the crystallization of the urine salts upon it.

Hydatids in the kidney may tend toward its surface rather than its pelvis, and may travel by an ulcerative process to a distance, and they have been known to open into an intestine, the stomach, and even into the lungs. It is thought the parasites sometimes die in their cysts, and the latter being contracted or obliterated, spontaneous cures very rarely take place.

The diagnosis, when no discharge of the parasites takes place, can only be made with certainty by aspiration, or by puncturing and obtaining the contents of the cysts and submitting them to an examination, when the characteristics found in hydatids of the liver will be observed.

The *treatment* will be the same as in hydatids of the liver, simple aspiration generally being sufficient. If it fails, electrolysis may be used, or the cyst may be laid open or injected.*

Other renal parasites—the *Strongylus Gigas*, the *Pentastoma Denticulatum*, the *Distoma Hæmatobium*, and the *Spiroptera Hominis* and *Dactylius Aenleatus*—are mentioned as possibilities in the human kidneys. Their discharge in the urine may take place. For their special description the reader is referred to works on human parasites.

RENAL CANCER.

The kidney is not a frequent seat of cancer, but it has a few times occurred in my experience, and in all the cases in men. It is more

* See Hydatids of the Liver.

frequent in men than in women. It may be primary or secondary, but within my observation it has oftener been primary.

It is more frequently of the encephaloid variety. It commences in the cortical substance, commonly in isolated points, which vary in size according to their age, but inversely to their number. The color varies according to the vascularity and the amount of pigment deposited. The foci gradually coalesce until the kidney becomes a cancerous mass. The organ is enlarged in volume, sometimes greatly, becoming in time of the size of an infant's head, and it may or may not preserve the original form of the kidney. It is said that the first seat of the cancerous change is oftenest in the epithelium of the tubuli contorti, but it may be in the interstitial tissue. The cancerous growth often extends beyond the limits of the kidney to different contiguous and even remote parts, and sometimes both kidneys are involved.

The symptoms, though becoming marked when the disease is advanced, are often slight at first, and the diagnosis for some time may be obscure. There may be little or no pain, no notable tumor, and there may be no change in the urine.

The cancerous cachexia may appear before its localization can be determined. When the general appearance of cancerous disease is present, a tumor in the locality and a change in the urine will lead to a diagnosis. The volume of the tumor is variable, but it is fixed in its position—does not move with the motion of the diaphragm. When the size becomes great, it will press the spleen and the left lobe of the liver upward.

It may so press upon the renal artery as to produce a systolic murmur resembling aneurism. When the tumor is very vascular, an objective sense of expansion with each heart beat may be felt when it is grasped, which suggests still more strongly an aneurismal tumor, and may lead to a false diagnosis.

Compression upon the veins, or thromboses, may cause œdema of the lower extremities and ascites; and there may be dilatation of the veins of the abdomen and scrotum. The most common change in the urine is the appearance of blood, and consequently albumen. Bloody urine may be the first symptom that induces the patient to apply for aid.

The quantity of blood varies, but it is sometimes large. A clot may obstruct the ureter, and the hæmaturia may abruptly cease. Should both kidneys be cancerous, as is sometimes the case, complete anuria might occur, with its speedily fatal results. Cancer cells are sometimes found in the urine, but their presence cannot be relied upon.

The sole termination is death, which is brought about by the

progress of the cachexia, by the loss of blood, by peritonitis, or by failure of the function of the kidney and consequent uræmia, or by these conditions combined.

The Treatment is symptomatic and palliative. It will consist in quieting the pain, which is sometimes troublesome, in checking the hemorrhage by ergot and astringents, in clearing the bladder and urethra of clots, and in sustaining, as far as possible, the strength of the patient. The preparations of iron, the bitter tonics, and a proper diet will be indicated.

DISPLACEMENT OF THE KIDNEY.—MOVABLE KIDNEY.

Displacement of the kidney, when it occurs, is commonly congenital, and is then of little clinical importance. When the displacement results from other morbid conditions, its interest depends upon those morbid states.

The movable kidney is a pathological curiosity, and has some practical consequence. According to the statistics of ninety-one cases collected by Ebstein, the right was movable in sixty-five, the left in fourteen, and both in twelve. This predominance in the numbers of the right kidney is due to the greater length of the right renal artery and to the depth of the organ itself. In these ninety-one cases, eighty-two of the movable kidneys were in women, and fourteen in men. It is most commonly seen after thirty years of age, but has been observed in infancy.

The *causes* are often obscure, but the peculiarity has been attributed to relaxation of the abdominal walls, to pressure of corsets, to diminution of perirenal adipose tissue in rapidly acquired leanness, to lifting heavy weights, to external violence, to hypertrophy of the spleen or liver, to displacement of other organs, and to increase of the volume of the organ in dropsy of the kidney, in cancer, hydatids, etc.

The symptom which usually first attracts attention is pain or a sense of weight in the region, oftenest in the right side, diminished or disappearing when the patient lies down. A physical examination reveals a tumor of the proper kidney shape, and sensitiveness on pressure. As in other circumscribed solid tumors in the abdomen, percussion directly over it will be dull, while all about it intestinal sounds will be produced.

There will be a normal condition of the urine, affording a negative sign, but excluding some other kidney diseases. Possible pressure on the crural or other nerves may give rise to neuralgic pains, while œdema of the lower limbs from pressure upon the veins is also

possible. There is often constipation, and most persons who have a floating kidney are nervous and excitable. In some cases the floating organ becomes very painful and enlarged. Its congested or inflamed condition, due often to rotation of the kidney upon its axis and pressure upon its nerves and vessels, may cause chills, fever, and vomiting. The ureter may be obstructed by the rotation, and accumulation of urine in the pelvis and calices (hydronephrosis) may result. Other changes in the kidney may take place.

The diagnosis is to be made by observing the character of the tumor, its size, location, mobility, reducibility to its proper position, tenderness on pressure, the neuralgic irritations, and the frequent depression experienced. It should be distinguished from a distended gall-bladder, a movable spleen, and various tumors, intestinal and others, in the region. The movable spleen is in front of the intestines, while the kidney is behind some of them, which makes the dullness on percussion greater over the spleen than over the kidney. The difference in the shape of the two organs affords another means of distinguishing them.

The prognosis is not unfavorable so far as this condition of itself is concerned, but its complications may produce serious results. It sometimes disappears spontaneously, or at least ceases to produce annoyance, at the menopause or when pregnancy occurs, and this result at other times may be favored by treatment.

Treatment, however, is in most cases but palliative. An elastic bandage properly applied so as to sustain the organ in its proper position will often afford relief, and painful symptoms may be combated by rest in bed, by morphine and other anodynes, cataplasms, and fomentations. Special complications must be treated according to their conditions, the stomach and bowels should receive particular attention, and hygienic regulations should be observed.

There are some anomalies of form, and even number, of the kidneys, which have too little clinical interest to require special description.

It is well to bear in mind the fact of anomalies in reference to the diagnosis of other diseases.

Diseases of the Renal Vessels may occur—atheroma and aneurism of the arteries and thrombosis of the veins.

They are rare as distinct affections, their clinical history is little understood, and they have no distinct therapeutics.

Hemorrhagic infarction of the kidneys sometimes occurs. Its pathology is similar to such infarctions in the lungs and elsewhere, its symptomatology is obscure, its diagnosis is generally impossible, and treatment for it is comparatively powerless. When symptoms

occur which conjecturally are referable to that state, they must be palliated according to their indications.

RENAL HÆMATURIA.

As a symptom of various morbid conditions, bloody urine has already been repeatedly mentioned. It occurs in acute hyperæmia of the kidneys, in acute parenchymatous nephritis, in amyloid degeneration of the kidneys, in cancer and tuberculosis of the kidney, in echinococci of these organs, in ischuria, in pyelitis, in renal cysts, in suppurative nephritis, in renal calculi, and in various morbid conditions of the ureters, bladder, and urethra. It is generally to be regarded as a symptom, and the nature of the lesion inducing it is to be inquired into. It may be the result of a general hemorrhagic tendency. It may be symptomatic of scorbutus, purpura hemorrhagica, of yellow fever, pernicious malarial fever, and hemorrhagic small-pox. In some of these cases the coloring matter of the blood, rather than the blood corpuscles, passes into the urine. The hæmoglobin is often set free in the blood by the rapid and excessive destruction of the blood corpuscles, and is separated by the kidneys without special lesion of those organs.

But decided hemorrhage from the urinary organs not unfrequently takes place where none of the distinctive diseases named can be recognized, and where the hemorrhage is the chief condition observed. In some of these cases it is profuse and persistent, and requires particular attention. It is sometimes apparently produced by lifting, or by some unusual exertion, and at other times it comes on without an appreciable cause. When the bleeding is from the urethra the case comes within the province of surgery, and so, usually, when it is from the bladder. The kidneys are beyond the reach of surgery. Excluding the urethra and bladder, the blood may come from the ureters or the kidneys. When from the ureters, it is generally produced by the presence of calculi in them, which would usually be accompanied by pain so severe as to be diagnostic. If blood casts of the uriniferous tubes are found in the urine, the hemorrhage is from the kidneys, either entirely or in part. The microscope is often essential to determine the presence of blood corpuscles as well as of these casts. Its use is the more necessary as various articles, such as logwood, madder, beet-root, etc., when ingested give rise to a color in the urine resembling blood. A moderate quantity of blood often gives a smoky appearance to the urine, but when it is free there is a brighter hue. After it stands long enough to become ammoniacal the blood corpuscles are often so

completely broken down as not to be recognized by the microscope, while the hæmatin by proper tests may be demonstrated.

In renal hæmaturia, if acute and considerable, cold over the kidneys by means of cold compresses often renewed, or the ice-bag, may be employed. The internal hemostatics—ergot, gallic acid, the muriate and other astringent preparations of iron, acetate of lead, and alum—are most frequently given for checking the flow. They are severally to be used in their ordinary full doses, and the selection of the particular article must depend upon the judgment of the physician in each particular case. Opium, by quieting a hemorrhagic erethism, is often more efficient in arresting bleeding than the astringents.

Sometimes hæmaturia is *intermitting*, and connected with a malarial influence. The antimalarial treatment—quinine in full anti-periodic doses—is the most essential. When any recognized morbid condition is present, of which the hemorrhage is symptomatic, this should receive the chief attention, unless the loss of blood is so rapid and great as to require the vigorous use of the hemostatic measures above mentioned. In all cases, however, reference must be had to the general condition of the system, and to whatever lesion of the kidney may be discoverable.

A form of hæmaturia in some tropical countries, particularly in Brazil, Egypt, and the Cape of Good Hope, has been ascertained to be produced by a parasite already named, the distoma hæmatobium. This worm, half an inch or so in length, is found especially in the vessels of the bladder, the mesentery, and other parts of the portal vessels, and the embryo and ova are found in the urine. Lesions are found in the kidneys and the intestines, which are thought to be produced by these parasites, and hæmaturia is among the results.

No certain method has been discovered for destroying the parasite, which is the chief indication; and the disease must therefore be treated symptomatically. Dr. Harley, however, to whom the credit of discovering the cause of this affection is due, advises the following mixture:

℞	Oil of Turpentine,	
	Oil of Male Fern.....	ʒā ʒxv
	Chloroform.....	ʒjv
	M.	

To be taken daily, with the object of destroying the ova in the urinary passages; and he also advises a solution of bicarbonate of potash to relieve renal pain and irritation. Besides this, he recommends injections into the bladder of wormwood, oil of male fern, and iodide of potassium properly diluted, for the purpose of destroying the parasite and its ova, which are often found in the cystic cavity.

This disease is said to be rarely fatal, but it may continue a long time, and greatly exhaust the patient. It is possible that this, or some other form of parasite, is the cause of some of the obstinate and protracted cases of hæmaturia occasionally met with in other localities.

HÆMOGLOBINURIA.

A form of paroxysmal bleeding from the urinary passages, not known to be connected with a malarial influence, has for some years past been described, but more recent investigations have shown that, instead of blood corpuscles and fibrine, the urine contains only the coloring matter of the blood, the hæmoglobin, and that the solution of the blood corpuscles does not take place in the urinary organs but in the blood-vessels, and is then separated by the kidneys. This affection has received the name of *periodic hæmoglobinuria* or *hæmatinuria*. The paroxysms vary in severity in different cases; but when decided, the attack is accompanied with a chill, lasting for some time, and occasionally, though not generally, is followed by a fever and a sweat.

Though sometimes so strikingly resembling a malarial affection, it occurs where the malarial poison is unknown, and is dependent upon some other cause.

During or following the chills the urine has a markedly bloody appearance, but more of a chocolate color than ordinary fresh bleeding from the urinary passages. A sediment of dark granular matter is found in the urine, and this fluid is albuminous and often contains granular and hyaline casts.

The paroxysm soon subsides, within twenty-four hours the urine commonly becomes normal, and, with the exception of some weakness, the usual health is restored. These paroxysms recur at regular intervals—sometimes after a few hours, but generally at longer periods, from a few days to a few months.

The seat of the disease is supposed to be not in the urinary organs but in the sanguineous system, as the hæmoglobin leaves the corpuscles in the vessels, and is only separated by the kidneys.

The cause of this condition is at present not known. A similar change in the blood occurs in some other diseases, as in hemorrhagic small-pox, and in purpura and scurvy; but in some of these cases, at least, blood corpuscles also appear freely in the urine, as well as in the hemorrhagic flow from other parts.

More or less “dissolution of the blood,” however, takes place in various diseases, in low fevers, etc., and in poisons from phosphorus,

from the inhaling of arseniureted hydrogen and carbonic acid. It may readily be supposed, from analogies which are now known, that some poisonous material is developed in the system, possibly in the evolution of parasitic organisms, which produces this decomposing effect upon the blood corpuscles and leads to the phenomena of this disease. But this is for the future to determine.

The paroxysms are more frequent in the winter than in the summer, and are often excited by cold. Careful avoidance of such exposure postpones, and sometimes apparently prevents attacks. Men are more subject to this affection than women.

The Diagnosis is not difficult in well-marked cases. The absence of blood corpuscles in the colored urine recently voided, as seen by the microscope, and the presence of hæmoglobin, as determined by the proper tests, together with the symptomatic phenomena described, will be conclusive.

The Prognosis is favorable, as no fatal cases have been reported, and recoveries have in most cases sooner or later taken place.

In the *Treatment* no specifics have yet been found. The paroxysms have been apparently beneficially treated by placing the patient in bed, applying heat externally, and administering warm and gently stimulating drinks. After the paroxysm, warmth to the surface and the careful avoidance of cold seems important. A warm and equable climate would doubtless be preferable to one that is cold and changeable. As the morbid change is in the blood, and the kidneys but eliminate materials which can be of no further use to the system, there seems no indication for the use of astringents.

Preparations of iron and other tonics, where debility and anæmia are present, would seem to be indicated; a proper diet should be directed, and all hygienic regulations observed.

CHYLOUS URINE.—CHYLURIA.

After a hearty meal a small amount of chylous matter is apt to appear in the urine. This is a frequent if not a physiological condition. A more decided chylous state, in which the urine resembles milk, is pathological, and is called chyluria. Sometimes a little blood is mingled with this material, giving it a pinkish hue. When abundant it forms, after its passage, a spontaneously coagulated mass, and it may coagulate within the bladder. When in smaller quantities it is readily coagulated by heat and nitric acid. The microscope shows the presence of fatty matter, and when this is dissolved by ether, the specimen of urine presents a more normal appearance.

Milky urine is occasionally passed by children and others, transiently and without any serious consequences. As a more permanent and morbid condition, it prevails in some tropical countries and occasionally in temperate regions. A few cases have been reported in this country.

The occurrence of the symptoms is quite irregular. The attacks come on without premonition, and generally without any assignable cause. The chylous condition may be constant, or only during part of the day. This condition may continue indefinitely, or the milky urine may appear for short periods with intervals of freedom from all symptoms; and this intermitting form of the disease may go on for days or for months.

In mild cases the health is but little impaired. In the more severe, there are lumbar pains and evidences of debility.

This affection is thought to be produced by an entozoön somewhat resembling the *trichina spiralis*, but smaller in size, to which the name of *filaria sanguinis hominis* has been given. At least this parasite was found by an observer in Calcutta in great numbers, after death, in the kidneys of persons who had been affected with the disease, and it has been supposed that they inflict some injury upon the lymphatics of the kidney, so that chyle passes out into the uriniferous tubes. This subject, however, needs further investigation, as in some cases of the disease the parasites have not been found, and their necessary causative relation to it has not been fully demonstrated.

The *Treatment* which has been thought to have most effect is the administration of *gallic acid* in quantities of one or two drachms daily in divided doses. The oil of turpentine has also been recommended; and a decoction of mangrove bark given in doses of an ounce or more, several times a day, is said to be a common remedy in British Guiana.

The subject of diabetes, as this affection cannot be regarded as a disease of the kidneys, has been considered in another connection.

So much space has been given to the morbid conditions of the urine and to renal diseases because of their great importance in themselves, and their frequent and intimate relations with other affections. The subject, however, has by no means been exhausted; and the methods of examining and testing the urine have been avoided, as there are numerous special works on that subject, and a satisfactory account of it would have extended this part of the work beyond its proper limits. The whole subject has been considered from the standpoint of the physician, but without entering upon the details of the chemical and microscopical investigations, an understanding of which, however, is necessary for accurate diagnosis. But few physicians in

active practice have the time or the means for perfecting themselves in all the processes necessary for a complete analysis of the urine ; and those who prepare themselves for such expert work must have the opportunity of making it a careful study with the aids which special works, appropriate apparatus, particular training, and frequent manipulative practice will afford. Every physician, however, should understand the indications of the different elements and substances found in the urine, and these an effort has been made to present.

DISEASES OF THE MALE SEXUAL SYSTEM.

SPERMATORRHIŒA.—PROFLUVIUM SEMINIS.—POLLUTION.

This has been defined a morbid involuntary loss of seminal fluid. Some have restricted the term to a seminal flow without erections and without a distinct orgasm, or to what has been called diurnal seminal losses ; but the term is usually employed in the sense above indicated, and is made to include those nocturnal emissions accompanied by lascivious dreams or a somnambulistic state, and often by an intense orgasm.

Most continent men who have had emissions, by whatever means excited, have occasional spontaneous or involuntary seminal losses. When these occur not oftener than once in two, three, or more weeks, and sometimes even when they are more frequent, they can scarcely be regarded as morbid. At least they often produce no apparent injurious effects. When they occur frequently, and in some cases when not so frequent, they are injurious in their effects, and are indicative of a morbid state.

Their occurrence with some, however seldom, excites great disgust, apprehension, and alarm, and is followed by marked depression of strength and spirits, and a deranged state of mental and bodily health. This is often due more to mental impressions than to physical injury. These impressions are produced by the exaggerated statements of the injurious effects of these losses made by advertising quacks, who by these means prey upon the ignorant and timid. When, however, these losses occur frequently in one who has no unusual sexual power, it is an evidence of a morbid irritability of the sexual system. The origin of this condition may be in the nerve-centres or in the sexual organs themselves.

There is great sexual activity at the age of puberty, and the promptings of strong passions and a prurient curiosity are apt to lead to acts of self-abuse which may become frequent, and at length an

established habit. That these acts of solitary indulgence are decidedly injurious, that they are unnatural, that without the associated conditions, mental and physical, of sexual intercourse a greater shock is given to the system than by coitus, and that more injury is likely to be done to the genital organs, to be followed by their weakness and a morbid irritability, does not admit of doubt.

In nervous and impressible boys these excitements at an early age are particularly injurious, inducing a premature and imperfect puberty.

The practice of exciting these organs sometimes occurs in children. Tight, rough, and too warm clothing, an elongated or constricted prepuce, and at a later period, but still in childhood, example and associations, or the reading of lascivious books, not unfrequently lead to an indulgence which becomes a tenacious habit. At length the weakened and irritable condition of the organs causes involuntary discharges, rarely diurnal or insensible, but more commonly nocturnal, with greater or less frequency, with lascivious dreams, and with more or less injurious results.

In many cases the practice of masturbation is continued after advice is sought, while in others the conscience becomes aroused, a deep, settled shame and remorse follow, exaggerated accounts of "lost manhood," of mental failure, of insanity and death are read; every emission reminds the young man of his former folly, and, as he now thinks, of his wickedness; remorse, despondency, and fear take possession of him; his thoughts are constantly upon the subject, to the exclusion of everything else; he is unable to apply himself to mental pursuits, and his attention being given only to subjects connected with his condition, he is forgetful of ordinary events, fancies his memory lost, and is in a most unhappy and melancholy state. The unfortunate patient fancies that those he meets can read in his face the story of his shame, and his life becomes a positive burden.

In many of these cases the emissions are infrequent, the nutrition is well sustained, and the disease is almost entirely mental.

Under promises of cure, the advertising charlatans reap a pecuniary harvest from the evil seed they have sown, but generally without benefit to the patient.

Every physician of much reputation sees more or less of these cases. Some need only moral treatment, as there is no physical disease to combat. Some are entirely free from seminal emissions, but have only an occasional discharge of prostatic fluid while at stool.

Others have only a slight urethral moisture from occasional erections; while others imagine, but without reason, that there is an insensible loss. A really morbid physical state, however, sometimes exists.

Excess in coitus may produce such weakness and morbid excitability in the system and in the genital organs as to lead to morbid seminal losses.

There is, however, no one fixed morbid condition of the genital organs in cases of spermatorrhœa. It is often a neurosis—it may be central—an increased nervous impressibility of the generative system.

The production of the seminal fluid is an organic act involving not only the secreting organs but the nervous system, and the emissions are reflex acts. The excessive production and the frequent and untimely emissions may depend on a derangement of the relations of the sexual organs to that portion of the nervous system which is concerned in the function, without perceptible lesions of any of the sexual organs.

Moral causes—lascivious thoughts, taking liberties with females, indulging in obscene literature, etc., while in conditions of physical and mental feebleness, will contribute to that result.

The **Symptoms**, when the emissions are so frequent as to produce mischief, are both objective and subjective. There is sometimes a peculiar facial expression, but one which arises mostly from the mental state. There is often an anxious, shy, confused, unsteady, and sometimes haggard expression. The patient seeks solitude. There is a failure of memory, but it is chiefly from want of attention. There is incapacity for mental application, but it is more from preoccupation of the mind with thoughts of the serious character of the disease than from the disease itself. There is often pain in the back, or a sense of weight, with feebleness of the lower limbs. The extremities are often cold, the hands clammy; and dyspeptic symptoms, with constipation of the bowels, are often present. The prostatic discharge, which is not uncommon, occurring for the most part when at stool, is quite as alarming to the patient as the real seminal emissions.

In severe cases lesions of the brain and spinal cord and of the genital organs may follow; and real diseases of the mind, monomania, or other forms of insanity, may, though rarely, result.

The testes may be painful and tender, the erections easily excited but feeble, the emissions quick, but slight and thin. In some cases a urethral and prostatic flow may occur with the erections, but without spermatic fluid.

Weakness of mind, a husky voice, palpitation of the heart, and other evidences of great nervous disturbance, may exist without discoverable structural lesions. A want of confidence as to the powers of coitus, or very speedy emissions often produce temporary impotence, but the impotence is not positive and permanent unless nerve lesions have occurred.

When masturbation is practiced early, before the brain is developed, the mental effects are sometimes serious. Insanity, when it accompanies excessive coitus, masturbation, or involuntary pollutions, may be either an effect or a cause. The same may be said of *tabes dorsalis*, or locomotor ataxia, of partial paraplegia, and of epilepsy; and in many cases it will be difficult to determine which is primary and which is secondary.

The **Pathology** of cases of spermatorrhœa is not always easily made out. The real cases of serious disease have been divided into tonic or sthenic, and atonic or asthenic.

Spermatorrhœa may depend upon a morbid condition of the testes, the *vesiculæ seminales*, the prostate gland, or of the urethra, especially at that portion of the urethra where the *caput gallinaginis* is situated, and at the opening of the seminal ducts. A hyperæmic and irritated or inflamed condition of any of these parts may result in a sthenic form of the disease.

An opposite state of these parts, or at least of some of them, and a modified condition of others, may result in an asthenic form of the affection.

Some diseases and injuries of the brain and spinal cord, by modifying the originating force of the one or the reflex susceptibility of the other, or by paralyzing inhibitory functions, may constitute the pathological condition which stands in relation to the result.

Though masturbation is by far the most frequent cause of spermatorrhœa, yet anything which will excite hyperæmia or a moderate inflammation of the testes, of the *vesiculæ seminales*, of the prostate gland, or of the urethra, may result in the disease. Anything which either primarily or secondarily will cause anæmia and atrophy with irritability of the testes, irritability of the seminal vesicles, the prostate gland, or the urethra, without hyperæmia, may produce a similar effect. And it must not be forgotten that morbid conditions of the brain or spinal cord may also be the cause.

There are various substances which excite the sexual organs, and may contribute with other causes to produce seminal losses. Astringents, by causing constipation of the bowels and straining at stool; purgatives, by irritating the rectum; cantharides, by irritating the kidneys, the bladder, and the urethra; coffee, by exciting these organs; much saccharine matter in the food, certain spices and irritants, and especially free quantities of concentrated and highly seasoned nitrogenous food, may have the effect.

With some there is a congenital debility and irritability; and with others a combination of predisposing and exciting causes, operating upon the system at large, may produce a similar constitutional state.

The exercise of the organs of generation is not essential to healthy individual existence. *These organs are for the propagation of the species, and not for the NECESSITIES of the individual.* Still, a proper exercise of them is perfectly consistent with the most vigorous health; and considering man in all his relations, such exercise is *most* normal. When exercised with due moderation under proper moral restraints—in constancy—it is best for the individual. Excess, however, is an evil, more frequent and more serious than the statements of many authors would lead us to suppose.

The question as to what is moderation and what is excess cannot be determined by any positive rule. Much will depend upon the comparative development of the organs, the general vigor of the system, and the amount of force expended in other directions. From the nearly equal numbers of the sexes, Nature evidently designed the union of one man with one woman; and the periodicity of the sexual activity of woman suggests a periodicity in that of man. I do not doubt that such periodicity is best for both, and the analogies throughout the animal kingdom sustain the correctness of this view.

Whenever the sexual act produces languor, depression, and debility beyond a very short period, it is an evidence of excess, and short of such decided feelings the general energy of the system and the capacity for labor, physical or mental, may be much impaired, the vital forces diminished, and the power of endurance overcome by the frequent indulgence. Coitus several times a week, continued for any length of time, must be regarded as excess. With some, much less than that would be excess.

TREATMENT OF SPERMATORRHOEA.

No class of cases require more care and delicacy in their management than these. Even where the seminal losses are trifling or imaginary, the mental suffering of the patient is so great as to appeal to the sympathy of the physician and to demand his best skill for its relief.

The first question that will present itself will be: Shall the patient be treated medically or surgically at all? It is seldom that the patient applies for treatment, even when the spermatorrhœa is imaginary, where some morbid condition cannot be found which is capable of being ameliorated or removed by treatment. As a rule, then, some treatment will be required.

It is unwise and often cruel to treat roughly or with ridicule even the groundless apprehensions of the suffering patient. This course is

more likely to destroy his confidence and to drive him to quacks, than to convince him of his error. Without admitting the correctness of his views or abruptly denying them, an effort should be made to gain his confidence and convince him of the truth by showing him the grounds of his error.

Symptomatic and tentative treatment should be instituted, but soon the patient should be frankly assured of his exact condition; and if no special treatment is required, he should be told so as soon as he can bear it.

If the emissions are only once in two, three, or four weeks, especially if they are accompanied by vivid dreams with the normal associated sensations, and if but little depression other than mental is experienced afterward, no treatment is required.

When treatment is called for, hygienic regulations are first to receive attention. All the causes exciting the sexual organs, which have been referred to, must be carefully avoided. The food must be plain, simple, sufficiently nourishing, but as a rule unstimulating. It must, however, be adapted to the condition of the patient and the type of the disease; it must not only be plain and simple, but for a time sparingly taken when the disease is sthenic.

The drink should be water. Coffee, much sugar, and spices should be avoided; bathing should be practiced, exercise enjoined, and general downright work should be advised. The patient should sleep upon a hard bed, should lie upon his side, should not be too warmly covered about the hips and back, and should never go to bed with cold feet, especially when the other parts of the body are warm and heavily clad. No late suppers should be taken, and the mind should be kept as free as possible from lascivious thoughts. If the patient unconsciously turns upon his back, and the emissions are more likely to occur in that position, a belt about the body, with some hard substance attached to the part over the back, so as to wake him when turning in that position, will be of service. I have known a large bottle of cold water, placed at the back, to allay the erections and excitement, and prevent the discharges.

Therapeutical measures should be directed to the pathological causes, whatever they may be. If there are ascarides in the rectum, cutaneous eruptions, irritation of sebaceous glands, stricture of the prepuce or urethra, hemorrhoids, or constipation, they should all be removed by appropriate measures.

When the disease arises from hyperæmia, inflammation, or irritation of associated organs, the condition being sthenic, this should be subdued. Antiphlogistic measures, salines, laxatives, leeches, counter-irritations, or cold applications, externally or by enemas, may be

required. If there be much pain in the parts, local anodynes will be called for.

Lallemand, regarding a morbid condition at the opening of the seminal ducts into the urethra as the chief pathological cause, recommended the cauterization of that point by nitrate of silver, but his *porte-caustique* for that purpose has had its day. It is at least now seldom used. The repeated introduction of a large-sized sound, which is allowed to remain in the urethra for some time, often diminishes the sensibility of the part and does good. It may be grooved, and smeared with glycerine and tannin, ten grains to the ounce, or with other astringent, alterative, or soothing applications. Whether most is accomplished by the physical or moral effect, it may not be easy to determine; but this treatment is often of marked service.

When the local condition is atonic, accompanied with general debility, a supporting and general tonic course is required. Quinine, iron, nux vomica, codliver oil, extract of malt, a better diet, etc., will then be useful. Patients sometimes say that when they are weakened by some disease the emissions are frequent, but when their strength is restored these are less so.

There are several remedies which are reputed to act specifically upon the sexual organs, either allaying or exciting their actions. Those which are supposed to allay excitement and diminish the sexual function are called *anaphrodisiacs*; while those which excite or increase the sexual power are called *aphrodisiacs*. In over-excitement of the function, the anaphrodisiacs are thought to be indicated; while when there is a condition of atonic irritability or real debility, the aphrodisiacs are called for. There is very justly much skepticism as to the specific action of many of the agents placed in these classes; but some of them either directly or indirectly seem to exert a decided influence over the function. The article which is most certainly anaphrodisiac is the bromide of potassium. Gelseminum, lupulin, and belladonna have claims to consideration. Bromide of potassium is a sedative to the nervous system, and diminishes reflex action. It is effectual in proportion to the functional character of the disease. In irritable testes, and indeed in most cases of excessive excitability and activity of the sexual organs, it exerts a sedative and often a controlling influence.

When attention is given to the rational indications, the bromide is often efficient in checking the frequency of the losses, and sometimes in arresting them entirely. When given in sufficient doses it seldom fails to produce a very perceptible and decided effect.

There are various prescriptions containing the bromide as the principal ingredient, of which the following are examples:

R	Bromide of Potassium.....	ʒ j
	Fluid Ext. Gelsemium.....	ʒ ij
	Simple Syrup.....	ʒ j
	Cinnamon Water.....	ʒ ij

M.—Dose ʒ j in a drink of water three times a day.

R	Bromide of Potassium.....	ʒ j
	F. Ext. Belladonna,	
	F. Ext. Gelsemium.....	āā ʒ ij
	Simple Syrup.....	ʒ jss
	Mint Water.....	ʒ ijss

M.—Dose ʒ j three times a day.

Smaller doses will frequently answer the indications, but in severe cases in vigorous persons the doses indicated will be best.

In debilitated and atonic cases, muriated tincture of iron, nuxvomica, phosphorus, phosphate of zinc, galvanism, and cantharides have a reputation as aphrodisiacs. They produce an alterative effect, and by their exciting properties may overcome a condition of irritable debility. These agents are often recommended, and sometimes used with benefit. In my own experience, however, the bromide of potassium, aided often by the introduction from time to time of a large urethral bougie or metallic sound, and sometimes by the use of astringent urethral injections, has been much more successful than the stimulating course, even where a degree of general debility was present.

Ergot has not unfrequently been prescribed, but I have not been impressed by its beneficial effects. It contracts the vessels of the spinal cord and may modify its reflex function; but of what character the action on the sexual organs is, or whether there is any specific action at all, is a matter not demonstrably established.

Some mechanical means for preventing the emissions have been used. The belt with a knot or a block in it for keeping the patient from sleeping on his back has been referred to. A *ring* has been contrived, to be placed upon the penis, which when an erection occurs will prick and awaken the patient; when, by evacuating the bladder, and perhaps applying cold water, the excitement will be subdued and an emission prevented. The importance of *work* must not be overlooked. Physical labor prevents the accumulation of excitability, which in idleness is apt to find its expression in excessive sexuality.

Patients often present themselves who have emissions once, twice, or three times a week, where no particular disease is present, but where the emissions use up an amount of vigor which should be expended in other directions. These patients, though not positively ill,

have less vigor and are less efficient than they would be did not this state of things exist.

There is an undue excitability of the sexual system, leading at length to debility of these organs and of the general system. Some symptoms and great apprehensions are experienced. There is often pain in the loins, increased by exertion, and inability to long continue active movements, and some degree of numbness or sense of formication in the lower limbs. There is in time a moderate and in some cases a decided degree of a depressed form of spinal irritation, or of *neurasthenia*. These symptoms are more marked in cases of greater severity, and in many cases of excesses in coitus, and especially where masturbation is still practiced, than in these milder ones of spermatorrhœa; but they occur also in cases of this kind, and the involuntary as well as the excessive voluntary excitement should be stopped. I have no hesitation in advising that these patients should receive prompt attention and treatment. Hygienic regulations should be enjoined, wrong habits of body and mind should be corrected, the bowels should be regulated, and whatever imperfection of organ or function is present should, if possible, be removed. The bromide of potassium in these cases should be prescribed, not pushed perhaps to extreme doses; and various other agents having a similar tendency should be combined. The patient should not be led to think that the emissions will be entirely arrested, but he may be encouraged to hope that they will be materially diminished, and that the general tone of his system will be improved. In some cases bougies and spermatie rings may be brought into requisition with advantage.

In most of these cases marriage is to be advised. Moderation in sexual indulgence should, however, be enjoined, and generally more natural and healthy sexual habits and conditions will be established. Young men affected with spermatorrhœa often seek advice as to their competency to establish proper marital relations, and the propriety of doing so. Unless there is evidence of important structural disease, or the case is an extreme one, marriage should be encouraged.

There may be embarrassment at first, with speedy emissions; but, as a rule, in time all difficulties and embarrassments will be overcome. Ergot has been particularly recommended in those cases where emissions are so speedy as to render the act of coitus unsatisfactory or impossible.

As habits of masturbation are often contracted in childhood, proper care in the association and management of children in reference to this subject should be observed. It is often a matter of embarrassment to parents in determining the course to pursue with children in this respect. It is better, if possible, to have them know

nothing of sexual matters until they are old enough to have an intelligent comprehension of the subject.

Association with other children precocious in such knowledge, or with those who are older and of prurient propensities, very often suggests ideas and practices in advance of the physiological development of the sexual instinct. As the period of puberty arrives, new ideas and sensations come without introduction.

Modesty is the chief protection against improprieties in both sexes, and it should be most carefully preserved. Moral and prudential principles should be presented on the subject when improprieties are suspected, and in order that they may have force, proper knowledge must be imparted. The time and the manner must be left to the judgment of parents and guardians of youth.

But physical conditions should receive attention. Stimulating foods and drinks should be excluded. Not much meat, or sugar and spices, no wine or coffee, should be allowed. The child should frequently be bathed in cold water, the clothing should not be too tight or too thick. The boy should not have pantaloons too soon. All "fast" habits should be suppressed. He should not sleep upon feathers, and should go to bed moderately fatigued.

He should rise early, and certainly not dally in bed with thick clothing. The brain should not be overtaxed, and all prurient literature should be kept out of the way. The character of companions and nursery-maids should be observed. If evidences of sexual excitement or of improper practices are discovered, an examination should be made as to the presence of physical causes, such as ascarides, irritations of the urinary organs, elongated or contracted prepuce, cystic deposits, an overfullness of the system, etc.

All such conditions should receive prompt attention, and, if possible, speedy removal.

Habits of masturbation in all cases, at whatever age, must by every means be broken up, and it must be borne in mind that denial of the fact will often be made. Tact will frequently be required to obtain proper information.

IMPOTENCY.

This word signifies an inability to perform the act of coition. It depends upon a variety of causes, and may be temporary and removable, or permanent and incurable.

Aside from anatomical conditions which come within the province of surgery, it may arise from an absence of desire, from frigidity or antipathy in the marital relation, from debility incident to various

diseases, from intense mental preoccupation, from depressing emotions, or from exaltation of the higher sentiments.

A premature decline of sexual power is more frequently dependent upon excessive indulgence, natural or unnatural. It is, on the other hand, sometimes the result of prolonged continence.

Impotence may exist without the loss of sexual desire, the incapacity, usually temporary, resulting from timidity or want of confidence.

With some the sexual instinct is naturally feeble, the organs small and deficient in power; and this reduced to a minimum, without disease, may amount to impotency.

As old age approaches the sexual instinct and power are usually and normally diminished. This is not always, however, the case, and prurient and lascivious old men are sometimes met with. This may be the result of cultivated habits, or of morbid conditions requiring treatment. Impotency, induced as it is by so many causes, requires very varied treatment in different cases.

There are various agents which are regarded as *aphrodisiacs*, as has already been mentioned, but their direct effects are doubtful. Their administration with that view may, however, give confidence to the timid, and in that way, if in no other, may be of use. The removal of the causes, and the administration of tonic remedies, conspicuous among which are strychnine, quinine, iron, and the preparations of phosphorus, are the chief means to be recommended.

As a specific for sexual debility *damiana* has been recommended, but its reputation has not been established.

Impotency, fancied or real, arising from self-abuse, can usually be overcome, and often by assuring the patient that the errors of youth are not so terrible in their consequences as they are often, for mercenary motives, so graphically represented to be. There is great virtue in repentance, and one who really reforms may hope to retrieve much that has been lost.

DISEASES OF THE BRAIN AND NERVOUS SYSTEM.

INTRODUCTORY OBSERVATIONS.

In all the higher animals a brain and nerves are essential to every proper manifestation of life. All functions, organic and animal, all activities of body or mind, are dependent upon, or in some way intimately connected with, the nervous system. This system establishes

connections and relations and maintains a harmony between different parts of the organism. As the nervous system has to do with the nutrition and the functions of every part, disease of that system is capable of modifying the structure and the activity of every organ and tissue of the body.

A knowledge of the anatomy and physiology of the nervous system must precede all knowledge of its pathology. This preceding knowledge, at least in its essential features, the reader is supposed to possess. It would extend this part of the work far beyond its proper limits, should an attempt be made to describe the details of the anatomical structures of this complex system, and the various functional activities of its different parts, as they are conjectured, alleged, or proven by modern investigation.

There are, however, numerous anatomical and physiological facts which must constantly be kept in mind. The component parts and the general divisions of the nervous system—the cerebrum and cerebellum, with their various ganglia and commissures, the medulla oblongata, the spinal cord, the sympathetic ganglia, and the nerves which spring from these several sources and convey influences to and from the various organs and tissues of the body—must be kept in view. The different kinds of nerve tissue—cells which originate power or receive and reflect impressions, the tubes transmitting forces, the stroma, connective tissue, and membranes, serving for the support of consistent structures and the protection of the more essential parts, and the blood-vessels and lymphatics sustaining the nutrition and affording materials to be converted into forces—all these must be remembered.

There are various functions of the nervous system to be recognized. The activities of organic life, or those essential to the *organism*, as nutrition, circulation, digestion, secretion, etc., are chiefly controlled by nerves differing in function from those concerned in *animal life*, or in the activities and susceptibilities connected with external relations. Sensation, voluntary motion, intelligence, will, passion, and all mental and moral qualities are spoken of as animal functions, and are distinguished from those activities of the body which have their analogies in the vegetable kingdom. The different nerves of organic life have special functions. Some are secretory, some trophic, some vaso-motor, and some calorific. Those of animal life have also their divisions as to function. Some are motor, some sensory, some reflex, and some are concerned with the special senses, as sight, hearing, and taste. There are excitatory and inhibitory or regulating nerve functions, connected with both organic and animal life.

There are various nerve centres and tracts, which may be arranged into divisions. Commencing with the lowest, we have, first, the organic; second, the reflex; third, the sensory; fourth, the ideational, and fifth, the volitional.

The portions of the nervous system which the fœtus has at the period of normal birth may be regarded as *fundamental*, and those parts subsequently developed, and which serve the higher functions of adult life, such as speech and various other complex and intelligent acts, as *accessory*. This accessory portion of the nervous system is less stable than the fundamental, and while the last to be developed, is generally the first to become diseased.

All these different centres and different divisions of cerebral and nervous activities are brought in relation and subordination to each other, and are connected with the periphery—with parts outside of the centres—by immense numbers of nerve fibres, distributed to the minutest parts.

From this brief and imperfect sketch of brain and nerve functions, the importance of their diseases will readily be inferred.

The fact must not be concealed that, in the present state of the physiology and pathology of the nervous system, there are many obscurities, uncertainties, and difficulties. In reference to no other part of the organism have there been so many observations and experiments, so much theorizing and so much contradiction. The subject of the localization of different functions in particular parts of the brain has occupied much attention, particularly within a few years past; and while many results of value have been established, the subject is still in a very unsatisfactory state.

Experiments upon animals, by exciting and destroying the activity of different portions of the brain, have been carried on to a very great extent, but they cannot be fully relied upon for conclusions as to the human brain, because in the latter there are susceptibilities and functions which do not exist in the former. Indeed, these experiments are not altogether reliable for ascertaining the functions of the different parts of the brain of the same animals, because of the sympathetic connections of one part of the brain with others, and because, in an animal under the influence of an anæsthetic, and after the mutilations necessary to reach the different parts of the brain to be excited or destroyed, manifestations of a very irregular and by no means uniform character are likely to take place. It is not surprising that different experimenters have come to opposite conclusions on so many points; and these conflicting conclusions prove the uncertainties connected with many experiments. Pathological observations upon the human subject are more reliable, but these are subject to great uncertainties,

and from them, also, many contradictory conclusions have been arrived at by different observers.

Into all the intricacies of localizations and the numerous speculations that have been indulged, it is not proposed here to enter, and especially so as this is intended to be a practical work, dealing with facts as far as possible, and avoiding speculations which lead to no therapeutical conclusions, and which do not result in benefit to suffering patients.

However desirable it may be to arrive at the truth in regard to many points which are in so much doubt, the time has not come for dogmatizing respecting them, and in what follows an effort will be made to keep within the bounds of well-established facts and principles.

Not only are there obscurities in regard to localizations of functions, but there are difficulties in determining the presence and extent of cerebral and nervous diseases which are not encountered in many other affections. The means of diagnosis are different from those which are applicable to disease of the lungs and heart, the pelvic, and several other organs. The symptoms are more subjective, and as the brain and cord are inclosed in the skull and spinal canal, and their functions are performed silently, they can seldom be physically explored. We must infer their diseases by changes in activities, mental or corporeal, and not by direct physical signs.

In disease of the brain and nerves some functions are irregularly excited—increased in activity—while others are diminished, and others still may be suspended, and all may be changed. Observing aggregate results, there may be doubts as to what is due to excitement of certain centres, and what to depression of others. Stimulation of excitor centres or nerves, and sedation or paralysis of inhibitory centres or nerves, may produce similar results—may cause increased but irregular action. Besides, irritation of one part of the brain by disease may, through sympathy, change the action of another part, and from this secondary effect symptoms may be manifested which may not be traced to their proper source. Besides the sympathy between different parts of the brain, there are sympathies between the brain and other organs, so that diseases of other parts affect the functions of the brain when it is free from primary disease. These effects may not be readily distinguishable from those resulting from primary cerebral affections.

In primary and essential brain disease, pathologico-anatomical investigations are often unsatisfactory. Some lesions of function are not accompanied with perceptible changes of structure, and changes

of structure of a similar character are not always accompanied by the same changes of function. In experiments upon the brain of animals results are not uniform, and in pathological observations in man a similar want of uniformity is observed.

In morbid processes affecting various structures and functions it is often difficult to say how much is due to wrong action of the nervous system, and how much to morbid actions of other structures; how much is due to the vaso-motor and the trophic nerves which control circulation and nutrition, and how much to primary changes in the other tissues. For example, it has recently been contended that gout, a disease generally regarded as dependent upon urate of soda, and perhaps other materials in the blood which irritate the tissues in which they are deposited, is neuropathic, depending upon primary morbid actions in the nervous system.

In the matter of convulsions or irregular motor functions, there may be uncertainty as to the essential cause of the symptom. There are various kinds of motions, normal and morbid.

1st. There is a simple contractile motion dependent upon the muscular tissue alone.

2d. Motion dependent upon the direct influence of a common motor nerve in exciting striated muscle.

3d. A motion may be organic—dependent on organic nerves and unstriped muscles, not under the control of the will.

4th. A motion may be diastaltic or reflex, dependent upon the spinal cord and muscles; and,

5th. We have strictly voluntary motions, dependent upon the brain, the spinal cord, and the muscles.

Any of the parts concerned in these different motor functions may, by their derangements, cause abnormal motions, and it is often a question as to where that primary derangement is.

Motions usually under the control of the will may occur with great violence, independent of or in opposition to the will, from a high excitement of the brain, or from paralysis of inhibitory functions.

Different portions of the brain are concerned in different kinds of motion. It is supposed by Herbert Spencer and others that the cerebrum regulates all alternate or clonic muscular contractions, and that the cerebellum controls the continuous or tonic contractions; but there is more or less uncertainty about this, and about many other physiological hypotheses of this character, rendering pathological conclusions uncertain.

In the different kinds of motion enumerated, not only different elements are concerned, but, when abnormal, the seat of the disturb-

ance may be in more than one of those tissues or parts, and complications very difficult to trace may exist.

That different parts of the brain have different functions there can be no doubt. The chief seat, at least, of intellection—of thought, and of will—is above the corpus callosum. Coördination of movements necessary to vital functions has its principal seat below—in the base of the brain and the cord—and many more divisions of the brain in reference to function are well established; but our knowledge of very many of the particular parts of the brain which perform particular functions, corporeal and mental, is too imperfect to allow of great positiveness of statement. Knowledge, however, in these respects is advancing, notwithstanding the difficulties which are in the way, and we may hope in the future for much greater certainty.

From the fact that different parts of the brain perform different functions, the particular seat of brain diseases must modify the symptoms.

Different neurotic agents as well as diseases affect the functions of the brain, producing excitement, perversions, suspension, or destruction. Alcohol, chloroform, opium, etc., change, suspend, or destroy action and sensation, thought and purposes, each in its own peculiar way, varied, however, in its effects by individual peculiarities of the persons upon whom it operates.

When the brain undergoes changes in its structure or composition—in its cells, tubes, vessels, or stroma—changes in function follow. The amount of blood in the brain and the rapidity of its circulation, and the quality of the blood, as well as the foreign substances that may be within it, modify its actions. Nervous influences modify the action of the heart and vessels, and these in turn, by determining the circulation of the blood, influence the conditions and activities of the brain.

As the mental functions are mostly manifested by the parts of the brain above the corpus callosum, disease above this commissure, generally though not exclusively, causes mental perversion. For similar reasons disease below this part more particularly causes perversion of sensation and motion. Diseases of the cord, as there are within it sensational and motor tracts, may cause perversion of sensation or motion, according to the part involved.

Disease or injury of the base of the brain is much more likely to be fatal than the same amount in the hemispheres above, as the hemispheres are not as essential to organic life. Speaking in general terms, we are likely to have mental disturbance from disease of the surface of the hemispheres, convulsions and paralysis from disease of the pons Varolii, and death from disease of the medulla oblongata.

The rapidity or slowness with which lesions occur influences the phenomena. It is quite possible that different portions of the brain are capable of performing functions different from those which are usual to them, when other parts are disabled. It may take time for a part to assume a vicarious function, and this may help to explain the greater disturbance of a sudden than of a slower lesion. In case of the growth of tumors or the occurrence of effusions, the slower processes give more opportunity for accommodation to the pressure.

In many instances different and even opposite lesions produce similar phenomena. Thus hyperæmia and anæmia may both result in a like diminution or perversion of function.

The particular anatomical changes in the brain, as in other organs, are various. Extravasations of blood, effusions of lymph, softening of structure, cancerous or tuberculous degeneration, pressure, disorganization or destruction of tissue, all destroy power.

A curious fact, more marked in brain diseases than in those of other organs, is that paroxysmal or periodical phenomena often result from permanent lesions. Thus pain, convulsions, and delirium are often intermitting where the lesion is constant.

The conditions of healthy innervation are: a certain supply of blood proper for nutrition, moisture to facilitate motion, a connection of vesicles and tubes in a proper state of integrity, and a free connection by nerves with parts performing functions. If any of these conditions are seriously interfered with, disease or death follows.

The subject of sympathy between the different portions of the brain has been referred to, but it is of sufficient importance to require more than an allusion.

Dr. Brown-Séquard now teaches that a limited local disease of *one part* of the brain tissue may, and often does, through sympathy, cause irritation of the cells of gray matter distributed in *other parts* of the brain and also of the spinal cord, so as to change or suspend their activities, with consequent paralysis and other morbid manifestations from these secondary impressions. He claims, and his experiments seem to prove, that when paralysis results from a particular localized lesion, it does not follow that the source or origin of the voluntary power is in the part of the brain suffering the primary lesion, but that other points in the brain or cord, which are the sources of the voluntary power, may be so irritated or impressed by the distant local injury as to have their functions changed or suspended. If this be so, as seems to me exceedingly probable, the cerebral seat of voluntary power may not be so extensively distributed as has been supposed, and this makes it more difficult to distinguish by symptoms the seat of lesions.

The importance of sympathetic effects upon the brain, of irritations in other parts of the body, is well known and generally conceded.

Convulsions are produced by irritations of the intestines, the uterus, and, in children, even of the gums; and irritations of the urino-genital organs and other parts may cause paralysis as well as convulsions.

GENERAL ETIOLOGY OF DISEASES OF THE BRAIN AND NERVOUS SYSTEM.

The *Causes* of the various diseases of the brain and nerves are very numerous. Some are *Intrinsic*, such as heredity, age, sex, race, nutritive disorders, sexual and other excesses, or abnormalities of functional activities, and various other conditions pertaining immediately to the individual.

Other causes are *Extrinsic*, such as traumatic injuries, compression by foreign substances or pathological growths, exposure to cold, circulatory disturbances, general or local infective diseases, diseases of other organs, chemical and organic poisons, psychical disturbances, and whatever influences may operate upon the system from without. More or less nervous disturbance occurs in all diseases, however originating, as the nervous system has to do with all parts and all functions. But brain and nervous diseases, particularly designated as such, have those special causes which will be more distinctly pointed out when treating of individual affections.

The *General Morbid Anatomy of the Brain and Nervous System* need not occupy much space in its consideration here, since the anatomical facts will be better understood when presented in connection with special diseases. We have changes of the proper nerve substance, *cells and fibres* (parenchymatous); of the *connective tissue* (the neuroglia); of the *blood vessels* (arteries, veins, and capillaries); and of the *blood itself* (toxic neuroses). These changes are various, and when one tissue is affected others are almost necessarily more or less involved. Changes in the amount of blood are frequent, it is often found outside of the vessels, and the changes of the tissues from the slightest modifications to complete destruction are observed.

GENERAL SYMPTOMS, DIAGNOSIS, AND PROGNOSIS OF BRAIN AND NERVOUS DISEASES.

The general symptoms of brain and nervous diseases consist of perversions of brain and nerve functions. These functions are numerous,

but may be arranged under various heads. We have *Sensory Functions*—those which convey a knowledge of external nature; *Motor Functions*—those which give the power of adaptation to the outer world; *Nutritive Functions*—those which provide for the support of the organism; and *Mental Functions*—those which perform the higher mental acts.

Any of these functions may be perverted in diseases of the nervous system, and these perversions constitute the chief phenomena and evidences of these diseases.

The aim of *Diagnosis* is to determine the existence, the seat, and the nature of the lesion which may exist. The fact of the existence of a nervous disease is more easily determined than its seat and nature. As to its seat, it is desirable to know whether it is peripheral or central, whether spinal or cerebral; and as to its nature, whether vascular (embolic, thrombotic or hemorrhagic, hyperæmic or anæmic), inflammatory, or degenerative; whether hypertrophic, atrophic, or the result of malformations, tumors, etc.

Brain and nervous diseases are to be distinguished, for the most part, by observing the rational symptoms or the changes in the vital phenomena. These symptoms are very various. There are, as the result of brain diseases, abnormalities of sensibility, of motion, of intellect and perception, and of all the functions of external relation. There are also abnormalities of digestion, absorption, circulation, secretion, calorification, nutrition, and all the functions of organic life.

There are morbid sensations in the head, in the spine, and in the course and at the termination of the nerves proceeding from the diseased part. The general sensations of the body may be acute or obtuse. There may be vertigo, depression, nausea, vomiting, spectra, sights and sounds without external cause, from excitement of the central nervous organs; flashes of light, ringing in the ears, deafness, smells without odorous particles, or loss of smelling; sense of crawling insects; illusions, hallucinations, and delusions; slowness of thought, rapid ideation, incoherence, loss of memory, delirium, mania, melancholy, imbecility, dementia, loss of consciousness, gloominess, wretchedness, stupor, sleeplessness, the loss of language or the power of expression; pains of different kinds and in different situations, general and partial hyperæsthesia or anæsthesia; diminished or increased reflex excitability; changes of temperature; muscular twitchings, rigidity, tremors, changed coördination of movements, debility, inability to appreciate resistance; paralysis, hemiplegic, paraplegic, or local; restlessness, jaetitation, abnormal attitudes and movements, automatic movements, cataleptic rigidity; vomiting,

constipation, scanty urine, diuresis ; sexual abnormalities ; dilatation or contraction or fixedness of pupils ; moaning or piercing cries ; picking of bedclothes, grasping at the void, reaching for fancied objects ; irregular respiratory movements ; irregular heart movements ; changes of general and special nutrition, etc.

Diagnosis.—These are called “brain symptoms,” and are evidences of primary or secondary diseases of the brain or nerve-centres.

The development and manifestations of *reflex action* are means of diagnosis in certain nervous affections, especially those of the spinal cord ; but these will be described in connection with the special diseases in which they are manifested.

There are some *physical signs*, especially in infants with open fontanels and sutures—fullness and sinking of the openings of the skull, and enlargement of the head. The shape of the head and the conditions of the spine may become evidences of disease of the brain or cord. And finally, the conditions of the vessels of the retina furnish evidence, though not always conclusive, of brain disease.

It will be seen from this enumeration of special phenomena that there are : 1. Morbid sensations in the head—most brain affections commencing with cephalalgia. 2. Morbid sensations connected with the spine. 3. Mental disturbance. 4. Subjective disturbance of the special senses of vision, hearing, smell, and taste. 5. Alterations of tactile sensibility, and of the general sensations. 6. Impairment of the muscular sense. 7. Alterations in mobility. 8. Changes in nutrition and secretion. 9. Derangements of stomach, bowels, kidneys, and sexual organs. 10. Mental disturbances.

These symptoms are to be considered, and their value estimated in determining the existence of diseases of the brain and nervous system.

There are various instruments and particular methods for investigating brain and nervous affections.

The *thermometer*, so important in all clinical investigations, is essential here, and a *surface thermometer*, enabling the observer to test the temperature of different parts of the skin, is often an important aid.

The *æsthesiometer*, an instrument having two movable points to ascertain the distance at which those points touching the skin can be recognized as two instead of one, thus testing the tactile sensibility, is also of use in many cases. Care in its use is important to avoid errors, and the necessary precautions will readily suggest themselves.

Dynamometers of different kinds—instruments for testing muscular power in the hands—are also useful, and the method of their use will at once be seen on observing the instruments.

The *ophthalmoscope* is brought into requisition in the diagnosis of

brain diseases, as well as in abnormalities of vision from diseases of the eye. The appearance of the retina—its hyperæmia or anæmia—is within certain limits indicative of the condition of the cerebral circulation. Its condition of œdema, the “choked disk,” a descending neuritis, chronic optic neuritis, red softening, retinitis, atrophy of the disk, and other appearances, are more or less significant of cerebral affections.

There are often important relations between cerebral disorders and diseases of the heart, arteries, and veins, and a careful stethoscopic examination of the heart, and an observation of the condition of the blood-vessels should not be neglected.

An examination of the urine, in these as in so many other affections, will often throw light upon the diagnosis and afford guides in treatment.

Electricity, as a means of diagnosis in brain and nervous diseases, as well as in their treatment, has assumed a position of much importance.

The application of this agent will be referred to when the various diseases which require it are discussed; but for a full account of the instruments for its production, and the methods of their use, the reader is referred to some of the numerous special works upon medical electricity. There is much loose and unscientific practice with this agent, and in treatment it is quite as capable of doing harm as good; and it should not be meddled with without a proper knowledge of its principles and the indications for its application.

The general treatment of nervous diseases, as they relate to the organism, is to be conducted on the principles which are applicable to affections of other parts of the system. Preventive treatment is no less important here than in other diseases. Proper hygiene, and especially proper early education—the management in relation to those accessory functions which are less stable and more prone to derangement—are of the greatest consequence, and will do much toward the prevention of nervous affections. The exciting causes, of whatever nature, must, if possible, be removed, the anatomical conditions modified, and the symptoms allayed by palliative measures. For accomplishing these purposes various means may be brought into requisition—proper regimen, internal medication, external applications, the use of heat and cold, electricity, and surgical operations. The particular application of these various agencies will be described when treating of the different special affections.

The *prognosis* is more favorable, other things being equal, in sensory than in motor nervous affections; more favorable in peripheral

than in central, often more favorable in cerebral than in spinal lesions, so far as complete recovery is concerned; very unfavorable in injuries of the pyramidal tract; and whenever faradic and galvanic irritability is entirely lost for a considerable time the case is desperate, and especially so if at the same time the vaso-motor and trophic disturbances are great, and the apertures of the bladder and rectum are uncontrolled. There may be exceptions to these statements, but the exceptions do not invalidate the general rule.

DISEASES OF THE BRAIN AND ITS ENVELOPES.

Although diseases of the brain and of its membranes are distinguishable pathologically, they are not always so clinically, and it is seldom that a morbid state of much severity of the membranes occurs without affecting more or less the brain substance, and disease of the latter is very often extended to its envelopes. Though distinctions between diseases of the brain and its membranes are recognized, it is thought proper to consider the two classes under the same general heading.

ABNORMALITIES OF CIRCULATION.—HYPERÆMIA.

It has been held by some comparatively modern pathologists that the quantity of blood in the cranium, from the incompressibility of its contents and the air-tight case inclosing them, must always be the same. This position, however, has been satisfactorily refuted by the rational arguments of Magendie, and the positive experiments of Burrows, Donders, and others. Without materially altering the brain pressure, the spinal fluid which freely passes from the ventricles of the brain to the spinal canal, or from the canal to the ventricles on the principles of gravitation and suction, allows of decided variations of the quantity of blood in the adult brain without impairment of function. Beyond a certain point, however, this variation cannot occur without change of function from either too great or too little pressure, or from too much or too little supply of blood. It is now admitted that different degrees of fullness or emptiness of the cerebral vessels may occur, but there are differences of opinion as to the extent, the frequency, and the importance of these variations. In the infant skull, with open fontanels and sutures, the quantity of blood evidently varies largely and from slight causes. It is as evident, however, that in the firm adult skull the quantity of blood cannot be

varied as much as in other organs of the body ; but from the confined condition of the brain in the skull, and from its tender structure, it cannot bear as much variation of its blood without producing symptoms, as can other parts. It is probable that in former times a diagnosis of hyperæmia of the brain was too often made, and its importance may have been exaggerated. Some symptoms formerly attributed to congestion are now regarded as being produced by anæmia ; but congestion undoubtedly occurs with sufficient frequency, and is of sufficient importance to require a careful consideration.

Hyperæmia of the brain, as of other organs, may be either *active* or *passive*. It may also be *acute*—sudden and transient in occurrence—or more *chronic*—slower in the onset and more persistent in continuance. The active form is spoken of as *fluctionary*, and the passive as *congestive*.

Active Hyperæmia—Causation.—The immediate causes of increased arterial pressure and flow, or of active and acute or more chronic hyperæmia, are various.

1st. Increased heart's action. This may be the result of simple hypertrophy of the heart, or of various causes, physical and mental, which excite this organ to increased action.

2d. Hyperæmia of the brain may be produced by the yielding of the coats of the vessels from weakness and relaxation of their walls. Diminished tonus of the vessels of the brain, as of the vessels of the face, will cause a “rush of blood to the head”—to the brain as well as to the vessels of the face.

The cerebral vessels may be relaxed from paralysis of the vaso-motor nerves, or possibly from excitement of the vaso-dilator nerves. Division or paralysis of the sympathetic nerve, excessive mental exertion, various reflex actions, and different toxic or medicinal agents—notably the nitrite of amyl and nitro-glycerine—may produce this effect. The excitator and inhibitory action of vaso-motor nerves and various mechanical arrangements regulate the cerebral circulation in health and keep it within physiological bounds. In disturbed conditions these bounds are exceeded, and symptoms are produced by the imperfect action of these regulating agencies.

3d. Diminished flow of blood to other parts from obstruction of vessels will cause collateral fluxion and active cerebral hyperæmia. Thus obstruction of the aorta below the origin of the carotids by stenosis, tumors, etc., by straining and compression of vessels by muscular action ; diminished circulation through the capillaries by cold to the surface or extremities, or by the long-continued application of water to the surface, or by obstructed circulation through other organs, as the kidneys or liver, will produce hyperæmia.

4th. Atrophy of the brain may cause more blood to flow to it from atmospheric pressure. The solid cranial space must be filled, and the blood rushes in to prevent a vacuum. The violence of the cerebral blood pressure from any of these causes may be sufficient to rupture the vessels.

Passive Hyperæmia.—Distention of the veins of the brain from deficient venous flow from the organ depends,

1st. On compression upon, or stenosis of, the jugular veins or descending vena cava. Compression may be produced by tumors, aneurisms, etc.

2d. On excessive expiratory efforts when the glottis is closed. In blowing, coughing, etc., the lungs have too little blood, and the general circulation, especially the cerebral, has too much. Pressure upon the veins below the head and above the heart keeps venous blood in the head. Pressure upon the arteries below the carotids throws arterial blood to the brain.

3d. Obstructive or regurgitative disease of the heart, especially of the right side, causes passive congestion of the brain. The veins and capillaries are all distended.

4th. Obstructed circulation through the lungs has the same effect.

Narcotic poisoning often produces hyperæmia, sometimes more active and at others more passive; but acute narcotism from alcohol or opium produces less hyperæmia than chronic poisoning from the same articles.

5th. Lastly. Plethory, whether temporary from free eating and drinking, or more permanent from increase of the blood-making functions, will tend to cause hyperæmia of the brain, which is not strictly or exclusively active or passive.

Morbid Anatomy.—The anatomical appearances of cerebral hyperæmia consist essentially of enlargements of the blood-vessels of the brain, the arteries or veins most, according as the hyperæmia is active or passive.

It is often difficult, however, to decide by *post-mortem* appearances the existence of hyperæmia during life. The vessels of the membranes especially may be distended hypostatically, from the position of the body after death; and the quantity of blood found in these vessels will depend not only upon the position of the body, but upon the time during which the blood remains fluid, the manner of dying, and upon the fact as to whether the skull or trunk is first opened. Opening first the trunk, if the blood remains liquid, may cause it to flow from the vessels of the brain, and thus give the appearance of freedom from congestion, though it may have been intense before death. On the other hand, when the skull is opened first, the veins at the surface

of the brain are usually full, especially in cases of sudden death, and where general anæmia or continued disease is not present.

We must look for evidences of congestion more in the substance of the brain and in the minute vessels than in the larger vessels of the membranes. A transient congestion, though intense during life, may disappear entirely after death ; but when the congestion is great and has continued some time, the cortical substance will have a rosy tint mixed with the gray, and there will be numerous small red points (*puncta vasculosa*) on the cut surface of the medullary substance. The small vessels of the membranes will be injected; and in many cases, especially in passive congestion, there will be effusions of serum into the tissue of the brain (œdematous) or into the ventricles, the choroid plexus, and between the membranes. This may exclude the blood or obscure its appearance in the tissues. The larger vessels may be distended, while the smaller ones may be comparatively empty, and this, together with the watery effusion, may cause the brain to be white, though congestion was the primary condition which produced the other results. In this case the capillary vessels, pressed upon by the increased quantity of blood in the larger veins and arteries, will not have a free circulation, and oxygenated and nutritive blood will not be properly supplied to the brain tissues. The result to the brain nutrition and function will be much the same as in anæmia.

Chronic Hyperæmia.—This is often the result of repeated attacks of the acute. It is often accompanied by thickening and opacity of the membranes, and the small vessels are sometimes more than twice their normal diameter. The perivascular spaces are diminished and sometimes obliterated ; and increased pigmentation in these spaces and in the walls of the vessels is often present. Chronic hyperæmia is often found in insanity, the cortical substance assuming a brownish and pigmented appearance. “According to recent researches nuclear proliferations in the walls of the vessels and in the fibrillary plexus of the cortical substance, and pathological changes in the ganglion cells or in the cortical connective tissue, occur in psychical disorders of a rapid course.” (Rosenthal.) These are regarded as evidences of a continued hyperæmia. Many of the *post-mortem* appearances of cerebral hyperæmia are inconclusive. More or less pigmentation may exist in a physiological condition, and the *puncta vasculosa* may be dependent more upon the fluidity of the blood than its increased quantity in the vessels ; hence positive statements that hyperæmia did or did not exist during life should be made with the greatest caution.

Although many and often severe symptoms are produced by changes in the quantity of blood in the brain, changes in its quality

and temperature produce quite as striking effects, which should also be recognized.

Symptoms and Results.—Usually in cerebral hyperæmia we have at first symptoms of excitement and afterward of depression of functions; but when the fluxion or congestion is excessive and sudden, the depression is primary. In the latter case the supply of oxygenated blood to the brain cells is diminished. It does not sufficiently enter the capillaries, and the brain is not sufficiently nourished.

Hence there is suppression and failure of proper function, while there is mechanical irritation of the brain substance. As already stated we have the effect of anæmia in severe hyperæmia, arising from the same cause—from a want of oxygenated nutritious blood circulating in the capillaries and coming in proper proximity to the brain cells.

The *Symptoms* are varied by the amount of hyperæmia, by the length of time it continues, by its active or passive character, and by the part of the brain most affected. Hyperæmia of the brain is apt to be general, but some parts may be much more severely involved than others.

Fluxion and irritation of sensory functions produce headache, often intense, increased sensitiveness, and often a development of subjective impressions and excitements. A moderate amount of light, sound, heat, or pressure, will produce abnormally vivid sensations which may be painful. Even when light is excluded there may be flashes, dazzling, and sparks subjectively perceived. Other visual illusions and hallucinations may appear. Though there is silence, there may be a sense of ringing or roaring. Though there be no ants, there may be a sense of formication. Pain in other parts as well as in the head may be experienced.

When the motor centres and tracts are affected, there will be muscular twitchings, or spasms, and there may be general convulsions. When these latter occur, some portions of the brain are usually paralyzed, and there is commonly complete unconsciousness. In extreme hyperæmia coma may occur, which may soon pass off, or death may follow. Congestive apoplexy is an illustration of extreme cerebral hyperæmia.

It is thought that the profounder phenomena produced from the pressure of blood in the larger vessels, or the œdema so likely to occur, are the results of excluding the oxygenated blood from the capillaries; but the mechanical irritation of the pressure coincides. Similar phenomena, however, may be produced by anæmia, and the exclusion of blood from the capillaries, or its obstructed circulation in

them, has a part in the production of the phenomena. Paralysis of *inhibitory* functions, as well as stimulation of the excitor activities, may produce violence of phenomena.

There is often psychical irritation shown in rapid change and loose connection of thought. This, too, may be the result of paralysis of inhibitory functions. False notions often occur, decided delirium is not uncommon; words may be whispered in the mind urging to insane acts, and illusions, hallucinations, and delusions are often produced.

Dizziness, sleeplessness, or disturbed or imperfect sleep, with vivid or half-waking dreams; talking in sleep, or other somnambulist phenomena may occur. In other cases there will be an insensitiveness, anæsthesia, slowness of thought, loss of interest and of ideas; while in severe cases profound sopor and complete coma, with more or less paralysis, appear.

The pupils are often contracted in excitement and dilated in depression. In excitement of the par vagum breathing is slower, deeper, and stertorous. In paralysis of the vagus the heart's action becomes more frequent. Vomiting often occurs from irritation of the brain. These and even other symptoms occurring in cerebral hyperæmia appear in varied groups.

Andral makes eight somewhat distinctive combinations. A brief enumeration of some of them will aid in giving ideas of the variety of phenomena which may occur.

1st. Irritating disturbance of sensibility, cephalalgia, sense of contraction or pressure in the head, ringing, flashing, formication, dizziness, vigils, dreams, and redness of the face and eyes.

2d. Hyperæmia from night study, often with paleness of the face. There may be doubt, in these cases, as to the actual hyperæmia of the brain. The symptoms here vary in duration, and somewhat in character. They are sometimes very brief, subsiding on rest and sleep. They may be aggravated or brought on by wine or coffee, even when taken in moderation. (Andral.)

3d. Marked mental disturbance. Some of these cases resemble acute mania, but are likely to be of temporary duration. There are anxiety, disquietude, depression, a "conscious delirium" in milder cases, with a more complete or unconscious delirium in others, with sleeplessness and sometimes violence. In some of these cases opiates aggravate the symptoms. There may be a frequent pulse, decided fever, but paleness of the face. This condition is often the result of excessive mental labor and exhaustion of the brain. Recovery is to be expected, and is usually complete, but, rarely, permanent mental disease follows, and occasionally a deep, stupid sleep or apathy succeeds the excitement, and this may be followed by coma and death.

4th. In another class of cases there are violent maniacal attacks. The patient fights and screams, laughs or cries, sings or curses, etc. He is often suspicious, has terrible fears, and tries to escape, especially in the more chronic forms. Some are afraid of particular places; others, in the more acute cases, of special events. A medical student under my observation, who had brought on an acute congestion of the brain by overstudy in preparing for examination, had a terrible, and, during the period of his illness, a persistent fear of being dissected, and the most frantic efforts were made to escape his classmates, who were taking care of him. He recovered completely in a week or two. This symptom of fear resembles that of delirium tremens, but the fear is more ideal and not so much connected with delusion of the external senses, and is more persistent in its subject. The history and other symptoms of the two classes of cases differ widely.

5th. In other cases of congestion a partial or more complete apoplectic state occurs. There is depression of all functions—a temporary or acute general paralysis. This striking down may be fatal. An œdematous state of the brain may be found. This form is not unfrequent in the intemperate. The other forms of Andral are less distinctly marked.

Diagnosis.—The distinguishing of cerebral congestion is important, but is sometimes difficult. Similar symptoms, as already stated, may be produced by different pathological conditions; but in this, as in most other cases, the pathological state, rather than the mere external symptoms, must govern in the treatment. Cerebral hyperæmia should be particularly distinguished from cerebral anæmia. The general condition of the patient, the history of the case, and the causes which have produced the attack, will determine the diagnosis even more than particular symptoms. All the conditions, however, must be taken into the account. In all cases care should be exercised in coming to a conclusion, and a positive opinion should not be expressed until the causes have been inquired into, and the conditions of the circulatory and respiratory apparatus have been observed. The heart, the lungs, and the vessels should be carefully examined, and also the state of the abdominal organs. The previous state of nutrition, the habits of life, the hereditary predisposition, and the existence of other morbid states, as hysteria, amenorrhœa, neuralgia, etc., must be taken into the account. Cerebral hyperæmia forms a part of the phenomena in tumors and other structural intracranial diseases. It precedes and accompanies encephalitis, tubercular meningitis, and other affections in which the nature of the disease is only revealed by its fuller development and subsequent history. The ophthalmoscope, however, will often be an aid in diagnosis, as the

vascularity of the encephalon commonly corresponds with that of the retina.

Cerebral congestion often occurs as a complication of spinal irritation, of hysteria, of convulsive affections, and the morbid state which results from long-continued mental overwork. It may occur in connection with seminal losses, with blows and injuries of the head, etc.

The particular symptoms which, properly interpreted, become evidences of the existence of cerebral congestion have been sufficiently described.

Prognosis.—This will depend upon the causes, the nature, and the duration of the case. The congestions due to partial paralysis of the vaso-motor centres, to alterations of the qualities of the blood, to abnormal cerebral excitability from temporary or removable causes, to overwork, to constipation, and other remediable derangements of the digestive organs, will generally by proper management be removed.

Those cases produced by profound organic lesions of the heart and vessels, the lungs, the kidneys, and liver, or of the central nervous system, may be palliated, but cannot be cured.

Arterial congestions usually run a shorter course, and often, though not always, have a more favorable termination than venous stasis. In a majority of cases the active fluxion is more controllable than the venous stasis. Symptoms of excitement are less to be dreaded than those of depression.

TREATMENT OF HYPERÆMIA OF THE BRAIN.

The essential immediate condition is too much blood in the brain, interfering with capillary circulation and with proper nutrition, and mechanically irritating and injuring the substance of the organ. The immediate indication is to diminish the blood in the brain and relieve the morbid pressure. When the onset is sudden and the symptoms severe, prompt action in fulfilling this indication is demanded; but when immediate danger is removed, another indication is then presented, viz., to combat the cause of the congestion.

A diminution of the quantity of blood in the general system, and as a consequence in the brain, can be most speedily and effectually accomplished by blood-letting, general or local. If there be general plethora, this can be done safely, and is the most appropriate remedy. In ordinary cases a moderate loss of blood is safe. In anæmic and debilitated cases, though temporary relief may be produced by blood-letting, its ultimate effects will be injurious, and other means should be substituted. Where bleeding is thought necessary, other means

must not be neglected. Among these is cold to the head, applied with a thoroughness proportionate to the severity of the case. At the same time derivatives should be applied to the more distant surfaces in the form of dry cups, sinapisms, warmth to the extremities if cold and shriveled; a hot mustard foot-bath is useful, and intestinal derivatives in the form of cathartics and enemata should generally be used. These means cause a freer flow of blood to other parts and thus derive from the head. The extent to which such means should be used, especially the cathartics, will depend upon the urgency of the symptoms, the strength of the patient, and the manner in which they are borne.

The choice of cathartics will also depend upon the conditions in each case. They should be of a character, and sufficient in quantity, to produce free evacuations.

Ligation of the extremities, so as to check the return flow of blood and detain an unusual quantity in the limbs, has a prompt temporary effect, and where the cerebral congestion arises from very temporary causes, this remedy is particularly applicable.

When the hyperæmia is from direct fluxion produced by simple hypertrophy or excitement of the heart, and is so severe as to threaten hemorrhage or other danger, bleeding may be required, and certainly sedatives and revulsives are indicated. Ice to the head, cups, wet or dry, ligation of the extremities, and revulsive cathartics may supersede the necessity of general blood-letting.

Cardiac and arterial sedatives, such as *veratrum viride*, *aconite*, or *gelseminum*, tartarized antimony, etc., will often be indicated.

If there be collateral fluxion from obstructed flow elsewhere, efforts should be made to remove the obstruction, while the ordinary means for deriving the blood from the brain are used. When there is constipation the bowels should be well evacuated.

If the cause be overstudy, or the use of alcohol or opium, which has been continued until exhaustion and relaxation of vessels follow, bleeding is not generally required, but often contra-indicated. Here cold should be applied to the head, while derivatives, as mustard foot-baths, sinapisms, perhaps dry cupping, and cathartics, should be used; and *bromide of potassium in free doses* should be given. This article is an important adjuvant in many other cases, and is the most important remedy in most subacute and chronic forms of cerebral congestion. In doses of from fifteen to twenty-five grains, three times a day, in cases of congestion from excessive study, its effects are generally markedly beneficial. It requires to be persisted in for a considerable time in cases of a few weeks' standing.

In chronic cases, besides the bromide, the fluid extract of ergot in

doses of from half a drachm to a drachm or more may aid in causing contraction of the dilated vessels.

Belladonna is also recommended, and iodide of potassium may sometimes be added with advantage, especially in cases where effusions or thickening of tissues are suspected. Counter-irritants of a more permanent character—the cautery or setons—are sometimes very useful. A seton in the nape of the neck will often produce in chronic cases a decidedly beneficial effect.

Galvanism in cases of relaxation and debility may be tried, and various tonics, in some cases of passive hyperæmia from deficient tonicity, will be of service. Quinine, iron, and arsenic are among the tonics to be prescribed. I must, however, express the opinion which has been forced upon me by observation, that tonics in cases of cerebral congestion are more frequently used than useful. Indeed, they are generally contra-indicated, and are admissible only in exceptional cases.

A moderate course of hydropathic treatment will in some cases be found useful; but this therapeutic agent, like every other of much efficacy, must be used with a full knowledge of its principles and with proper discrimination.

When cerebral congestion occurs, as is not unfrequently the case at the menstrual period, with a scanty or suppressed flow, leeches should be applied to the os uteri or to the anus, or wet cups may be applied to the thighs. The effect of removing a small quantity of blood by the leeches is often wonderful. A warm sitz-bath is often relieving; and in case of suspension of the flow, warm douches to the loins and perinæum, and the electric brush to the thighs may be useful. Moving the bowels with a warm, stimulating enema will often procure relief.

In *portal congestion* great benefit is often derived from saline and alkaline solutions. The mixture of sulph. of soda, bicarbonate of soda, and chloride of sodium in a free quantity of warm water an hour before breakfast, continued for a few weeks, in mildly laxative doses, will often be of very great service.

When there is pressure upon the veins, causing passive congestion, it should be removed if possible. In serious obstruction at the heart or lungs, if much congestion of the brain occurs with alarming symptoms of depression, copious venesection may be demanded, especially if the patient be vigorous. In the aged and feeble, derivatives must be the chief reliance. Where the heart's action fails from dilatation, etc., digitalis and the phosphate of iron, quinine, and strychnine, will be required.

If the cause of the congestion be from overfeeding and plethory, the quantity of food must be reduced and saline purgatives adminis-

tered. If there be urgent symptoms, bleeding must be practiced. A few leeches inside the nostrils, producing an artificial nose-bleed, will often afford prompt relief.

In cases of long standing, where bromides and ergot are not well borne, arsenic is advised, and may have a trial. The hydrobromic acid has its advocates, and may be adapted to certain cases. After the hyperæmia is past, and a relaxed and debilitated condition remains, the elixir of phos. of iron, quinine, and strychnine, phosphoric acid, phosphate of zinc, etc., may be indicated.

In hyperæmia due to exaggerated excitability of the general system and derangement of the vaso-motor nerves, accompanied by changes in the quality of the blood, a change of climate and scenery will often be of great service, especially a sojourn in some elevated situations, with the use of mild ferruginous waters or medicines; and the proper employment of hydropathic measures is especially serviceable in diminishing excessive reflex excitability.

On the continent of Europe a summer sojourn at St. Moritz, in the Engadine—an elevated valley containing a spring of mild, ferruginous water, with bathing facilities, good society and hotels, and magnificent surrounding scenery—is often beneficial. Similarly situated resorts may be found in our own country.

Some persons have constitutionally a feeble vaso-motor system. They generally have a soft, moist eye, a dilated pupil, and a thick, drooping upper eyelid. In these the nervous system is not well balanced, and is readily disturbed by excitement. The heart is often irregular in action, and the vascular circulation is morbidly variable. Such persons are easily upset by excessive exertion, by alcohol or tobacco, and by sexual indulgence. The cerebral circulation is frequently if not habitually disturbed, and a variety of symptoms due to cerebral congestion are observed.

Hygienic regulations with such persons must be strictly observed; alcohol and tobacco must be avoided; sexual indulgence must be very moderate; the head must be bathed in cold water several times a day; a regulated diet in which plenty of milk enters, if agreeing, should be prescribed; bromide of potassium, or bromide of ammonium, or dilute hydrocyanic acid may be given to control temporarily the excitement; and various tonics, such as syrup of lactophosphate of lime and iron, nux vomica, or pills of phosphorus, should be taken for more permanent effects. A bracing atmosphere will also be of service.

There are chronic cerebral congestions with tendencies to relapses, depending upon various organic pathological causes. These latter must furnish the indications for treatment. In incurable organic

affections of the heart or lungs, soothing and palliative measures are indicated. In chronic alcoholism, the abandonment of the poison, the use of bromide of potassium, the oxide of zinc, and a careful regulation of hygienic conditions will be required.

When the trouble arises from mental fatigue and other mental and moral causes, mental rest, often for a long time, and change of scenes and associations are largely to be relied upon.

The digestive organs will often require special attention, and the same is important with reference to the pelvic organs of women. An examination of the urine should not be neglected, and its indications, if any are presented, should be followed.

Insomnia is a symptom in these cases which is not infrequent, and one which does not always yield to hypnotics. Indeed, should narcotics for the time being procure sleep, they should not be long continued lest reliance upon them be established and a growing habit of narcotism be fixed upon the unfortunate sufferer. An evening bath or pack, or affusions to the back and head, generally used cool, but at such temperature as is best adapted to each particular case, will often be followed by refreshing sleep. The feelings of despondency and terror sometimes experienced in these cases are said to be often removed by hydro-therapeutic treatment.

In the preceding account reference was had to a general hyperæmia affecting similarly the whole or a large part of the brain, though some parts in such cases are usually more severely affected than others. *But hyperæmia is sometimes limited to particular portions of the brain*, while others may be in an œdematous or anæmic state. This state of things commonly arises from causes within the cranium, such as tumors, extravasations of blood, emboli, thromboses, injuries, local inflammations, etc. These lesions cause irritation and active hyperæmia of the parts around them, or by obstruction of veins may cause passive congestion.

In such cases the symptoms will vary according to the location and the severity of the irritation and congestion; and these symptoms will be mingled with those of the original disease.

The *treatment* of localized and limited hyperæmia will be conducted on the same principles as where the hyperæmia is more general. Hygienic management will be important in all cases. Rest will be required when there has been overwork; diversion may be needed when there has been devotion to a single pursuit; exercise, massage, bathing, etc., may be called for, and various other special remedies as the case may demand.

CEREBRAL ANÆMIA.

Pathological Anatomy.—A condition of deficiency of blood in the brain, the exact pathological opposite of the state which has just been considered, not unfrequently occurs. In this state the brain is pale, the puncta upon the cut surface are few or absent, the meningeal vessels are usually empty and collapsed, though the vascular canals of the dura mater, and the large venous trunks are often better filled; and in some cases there may be hyperæmia of the meninges, while the brain substance is anæmic. The pia mater is often thin and transparent, and between it and the arachnoid, and within the ventricles, there may be considerable quantities of serum. The medullary substance is of a dull white color, and the gray substance, from its paleness, is not as distinctly defined as it is normally. The cerebral parenchyma may be either dry and firm, which is more common, or moist and soft, which is rare. The anæmia is general when dependent upon a comparatively bloodless state of the system at large; but it is partial and localized when the result of certain intracranial lesions.

Etiology.—The causes of cerebral anæmia are: 1st, Loss of blood in the system. This may arise from hemorrhage, or from a deficiency the result of diminished nutrition, of starvation, or of a failure of the blood-making functions. Disease of the liver, spleen, and other blood glands; consumption of the blood, as in fevers, inflammations, and free suppuration; loss of fluids and nutrient materials, as in diarrhœa, cause a general deficiency of blood, and produce anæmia of all parts of the body, including the brain. In hepatization of the lungs a large quantity of the constituents of the blood is withdrawn from the circulation and deposited in lung tissue, and that, together with the hyperæmia in surrounding portions of the lungs, often markedly depletes the brain. In the profuse or protracted diarrhœa of children, and other exhausting diseases, anæmia of the brain often becomes extreme, and symptoms so much resembling those of hydrocephalus appear, that they are called hydrocephaloid.

2d. Hyperæmia of other organs, and irregularity of circulation of the blood may leave the brain anæmic. Ligation of the limbs, or the application of Junod's boot, by detaining a large quantity of blood in the veins of the extremities, will diminish the amount in the brain. The erect position in weakness, and general anæmia, and feebleness of the heart's action produce the same effect.

3d. Compression of arteries leading to the brain, ligation of the carotids, or emboli of these or other arteries supplying the brain,

will arrest the flow of blood and produce anæmia, and at length softening.

These causes, as has long been known, when acting suddenly often produce with the anæmia epileptiform convulsions, as well as syncope.

4th. Emotions sometimes produce spasms of the arteries of the brain, and various forms of abnormal innervation cause cerebral anæmia. Vaso-motor disturbances with syncopal attacks may occur from reflex irritations, and from a variety of external impressions or internal states. Various medicinal or toxic agents, as large doses of belladonna, chloroform, ergotin, nicotin, etc., cause contraction of cerebral vessels and consequent anæmia. Faradization of the cervical sympathetic, irritation of some peripheral nerves, electrical or mechanical irritation of the walls of the stomach, and various other similar conditions often cause narrowing of the cerebral vessels and consequent anæmia. In electrical excitement or mechanical pressure of the cervical or thoracic portion of the spinal cord in certain conditions of irritability, in hysteria and allied conditions, sudden attacks of cerebral anæmia are apt to occur.

5th. Pressure from tumors, effusions, hemorrhages, etc., in the cranium, will exclude the free flow of arterial blood from some portions of the brain, though there may be hyperæmia in others.

6th. The blood, though sufficient in bulk, may be poor in red corpuscles, in the oxygen carriers, and in nutrient properties, producing some of the phenomena of anæmia.

Cerebral concussion from physical violence produces its effects, in part at least, by causing sudden anæmia, or diminished circulation in the brain. There are loss of consciousness, dilated pupils, slow and deep respirations, irregular pulse, and often vomiting. When the case is not too severe, restoration takes place, and is generally complete, but sometimes more or less impairment follows. In some cases of shock following traumatic concussion, recent experiments render it probable that reflex paralysis of vascular nerves, especially of the splanchnics, causes distention of the abdominal veins and an afflux of a large amount of blood into them, and thus drains that fluid from the brain, skin, and muscles, producing the pallor and the grave symptoms which are observed.

Symptomatic Phenomena.—The symptoms of cerebral anæmia are produced partly by deficiency of oxygenation and nutrition of the brain, and partly by deficiency of pressure. When the anæmia occurs suddenly, the symptoms are probably produced more from the destruction of the normal tension than from the deficient oxidation. The most common marked phenomenon of acute cerebral anæmia is syncope. This is usually attributed to failure of the heart's action,

which may be the preceding cause of the unconsciousness. The occasional spasms, and the loss of power, are the results of a deficient supply of blood to the brain. Loss of sight and hearing, a sense of faintness, distress for breath, and various other symptoms follow a sudden diminution of cerebral circulation. When this diminution is not so great, a sense of giddiness is a very common symptom.

In the slower cases appearances of irritation often precede the failure of function, and some actions are increased. This, however, may be due to failure in the activity of the inhibitory nerves. Increased activity, it must be borne in mind, is not always the result of stimulation. Paralysis or lowering of *inhibitory* functions, the effect of sedative agencies, may indirectly produce increased action.

In cases of anæmia of the brain the symptomatic excitement may not only be the first, but the chief observable phenomenon. Whether due to the lowering of inhibition, or to the reactionary efforts of the system, the symptoms may be only such as are produced by increased activity. There will usually be disturbed sensibility, severe headache, sensitiveness to sounds and light, flashings, roarings, etc., but with paleness of the face and prostration of general strength. There will be disturbance of motor functions, muscular and general irritability, restlessness, often spasms and fever, and sometimes eclampsia, collapse, insensibility, coma, and death. These phenomena resemble in some respects those produced by excessive hyperæmia. It will, however, be remembered that in hyperæmia of the larger vessels, anæmia of the capillaries may produce the chief effects.

When the surface of the cerebrum (the cerebral ganglia) is most affected, mental symptoms will be prominent. There may be either sleeplessness or sopor, and delirium is not unfrequent; there may be active frenzy, and when the case is an extreme one, there may be loss of consciousness, and fatal collapse.

Anæmia of the medulla oblongata results in disturbance of respiration and circulation. There may be great frequency of breathing, and when the vagi are paralyzed, rapidity of the heart's action occurs.

Diagnosis.—The distinguishing of cerebral anæmia from other conditions, and especially from hyperæmia, is of great importance. In children the two opposite conditions, though so diverse in their remote causes and in the indications of treatment, so much resemble each other in many of their phenomena as sometimes to lead to their being confounded. The symptoms of exhaustion and cerebral anæmia, especially after protracted diarrhœa, so much resemble those of hydrocephalus, as to have induced Marshall Hall to apply the term "hydrocephaloid affections" to these cases. Attention to the preceding conditions of the disease is important. When there have been

poor and insufficient food, persistent diarrhœa, or other long-continued debilitating influences, the presumption will be that anæmia is present. If the fontanels be depressed, the cheeks, nose, and limbs be pale and cold; if the eyes be half closed and the pupils equally dilated; if there be no strabismus or hemiplegia; if there is somnolence, with hoarseness of voice, and an occasional dry, hacking cough, the diagnosis of anæmia should be positively made.

Previous hemorrhages, debilitating discharges, and apparent deficiency of blood in other parts of the body, from whatever causes, will facilitate the diagnosis of cerebral anæmia in adults.

The following comparison is suggestive of the differences of the symptoms in hyperæmia and anæmia, and may aid in their distinction:

CEREBRAL CONGESTION.	CEREBRAL ANÆMIA.
Headache (generally diffused). Noises in the ears, generally rumbling or singing. Mental disturbance—loss of memory, hallucinations.	Headache, chiefly vertical. Noises in the ears, generally sharp and short. Mental disturbance—incapacity for mental work.
Pupils contracted. No morbid heart sounds, unless there be valvular insufficiency. Pulse full.	Pupils dilated. Aortic murmurs often, pulse irritable, sphygmographic tracings almost straight.
Urine not increased, generally contains urates and phosphates.	Urine passed in large quantities, clear and limpid. (Hamilton.)

These symptoms are not uniformly as stated in the different cases, and a diagnosis will depend much upon what will be judged to be the general condition as to the quantity of blood in the system.

Prognosis.—This will depend upon the extent of the anæmia, and the persistent or remediable character of the causes which have produced it. Speedy death or speedy recovery may follow shock, and great loss of blood may result in speedy death or in gradual recovery.

TREATMENT OF CEREBRAL ANÆMIA.

The general course of treatment in cerebral anæmia cannot be doubtful. Every means should be resorted to for the purpose of restoring to the brain its necessary amount of blood. In acute and dangerous losses of blood, as from profuse hemorrhages from whatever source, transfusion, where practicable, should be resorted to. The head should be placed low, warm drinks should be administered, and

stimulation in the proper sense of the term is desirable. Alcoholic drinks are generally advised, and when shock is present they, as well as ether, chloroform, and opiates, are often useful. Dr. B. W. Richardson doubts, or rather denies, the usefulness of alcohol in simple losses of blood, and to my mind there are good reasons for doubting its direct stimulating effect. By relaxing the cutaneous vessels, as it tends to do, it might withdraw the blood from the brain, and in that way do harm. I must say that I have witnessed more marked beneficial effects from hot coffee, or tea, and spiced drinks than from alcoholics. No one of large experience can have failed to observe that the act of vomiting after excessive hemorrhage has speedily restored the depressed patient to a state of comparative animation and comfort. This effect is due to the quantity of blood thrown to the brain in that act. The abdominal organs are compressed, the flow of blood through the abdominal aorta is for the moment diminished, and the current turned toward the brain. This has suggested to me firm pressure upon the abdominal aorta in faintness from hemorrhage; and in post-partum cases it has had the double effect of checking the loss and turning a stronger current of blood toward the upper parts of the body. Firm pressure upon the uterus in these cases produces part of its beneficial effects by the coincident pressure upon the aorta and the iliac arteries. The expedient of pressure upon other arteries, with the view of causing temporarily a greater flow of blood to the brain, is worthy of attention and trial.

The use of alcohol in cerebral anæmia, though so long sanctioned by custom and authority, like many other authoritative customs, is at the present day open for reconsideration; and the question of the direct stimulating effect of alcoholics on the heart is by no means affirmatively settled. In health the sphygmograph, often at least, shows a diminished rather than an increased force of the heart's action from its use, and this appears to be the fact in some abnormal states. In cases of sudden depression from shock, it appears to do good. It doubtless has its uses, but its general applicability in these cases may well be questioned. Ammonia, Hoffman's anodyne, camphor, ether, etc., relieve faintness and other immediate effects of great losses of blood.

For more permanent effects in losses of blood all possible means for the increase of nutrition are indicated. Beef-tea, raw beef, milk, well cooked farinaceous substances, and other nutrient materials must be supplied. Moderate, or even small but often-repeated quantities of food may be required for a time; and iron, quinine, phosphorus, etc., may be demanded. The use of moderate quantities of wine or beer, or a little dilute spirits, may in some cases invite the blood to

the stomach and excite appetite and promote digestion, and may sometimes be tried. It should ever be borne in mind, that it is the quantity of food digested and appropriated which increases blood and strength, and not the quantity taken. The mistake of overfeeding may readily be made.

The causes of cerebral anæmia should always be inquired into, as radical relief must consist in their removal. To consider the treatment of them all would take us over a larger field than is necessary in this connection. The various discovered causes will suggest the remedies.

There is, sometimes, arterial anæmia with a degree of venous congestion, and in these and perhaps other cases a bleeding will give temporary relief. It may hasten the escape of venous blood and favor the flow of arterial. Its ultimate effect, especially if repeated, can but be injurious, and the practice, of course, is to be condemned. An oft-repeated and long-continued hemorrhage, as from bleeding piles, when arrested, as by an operation for that disease, may be followed by congestion and extreme cerebral suffering, for which the patient seeks relief by inducing a loss of blood. One case came under my care where hemorrhoidal losses had occurred for many years, and extreme general anæmia had resulted. When the hemorrhoidal tumors were ligated and the accustomed bleeding prevented, the sufferings of the patient from the increase of the blood, and its greater pressure, induced him to use violence to produce epistaxis. From this he could not be restrained. The management of the case presented insuperable difficulties, and he continued to cause bleeding of the nose until he died. When long-continued hemorrhages are arrested in less extreme cases, some drain to the system may for a time be substituted. Purgatives, diuretics, and diaphoretics would be suggested, *and a dry diet* might be prescribed.

Local Anæmia of particular parts of the brain, with a normal or even congested condition of other parts, may occur. The plugging up of certain arteries by emboli, atheromatous or other degenerations of the vessels, the pressure of tumors or effusions, may diminish or cut off the circulation from particular parts, and result in failure of function, and sometimes in softening and necrosis. Compression from effusion of blood, contraction of cavities after apoplexy, or traumatic lesions, may result in local anæmia.

The symptoms will vary according to the extent and location of the disease. Loss of power or paralysis of some function is a common result. Motor or sensitive paralysis, aphasia, mental disturbances, etc., will be produced according to the part of the brain involved. A

fatal result will of course follow when a part of the brain essential to life is the seat of a sufficient anæmic lesion.

Treatment.—This will be varied according to the conditions of each case. The indications are to remove the cause and palliate the symptoms. Some of the causes are of a character to admit of removal, while others are not. A tumor, a cicatrix, or an occlusion of an artery by its degeneration, will not be materially influenced by treatment. A hemorrhagic clot or an embolus may be absorbed away, and the process may possibly be influenced by treatment—by supporting measures and sorbefacients. Whatever conditions are present capable of being influenced by remedial measures, should receive attention. Supporting measures are generally required, and the means for palliation of special symptoms will depend upon their character. Often but little can be done, and mere tentative management will alone be required.

It will be noticed that, judging from the subjective symptoms, it is easy to mistake a case of anæmia for the opposite condition of hyperæmia. The history of the case and general condition of the patient, the state of the pulse, the apparent amount of blood in the system, whether there be the usual causes of anæmia on the one hand, or of hyperæmia on the other, whether there be obstruction of circulation *to* the brain or *from* it, whether there be an obstructed or freer flow to other parts, etc., must all be observed.

It must also be borne in mind that diseases of the stomach or bowels, or of the pelvic organs, may change the activities of the brain through sympathy without necessarily changing the amount of blood in the organ. Impurities of the blood may also produce symptoms easily confounded with those of hyperæmia or anæmia. Oxalæmia, Bright's disease, the impurities of the blood from hepatic affections and severe dyspepsia, are examples.

Softening or hardening of the brain coming on slowly may produce symptoms of failure of power more or less resembling those which have been described. But in these latter conditions, especially in softening, which, by the way, may be produced by anæmia, the symptoms are more severe, progressive, and fatal; and in hardening they are continuous and persistent.

Auditory diseases, and, finally, inflammation of the brain or cord, when moderate in degree and gradual in approach, may not be readily distinguishable from simple hyperæmia. The treatment, then, in cases presenting appearances of cerebral anæmia, must be well considered and its effects carefully observed.

INFLAMMATION OF THE BRAIN AND ITS ENVELOPES.—MENINGITIS.—CEREBRITIS.—ENCEPHALITIS.

Though an inflammation may be confined to the membranes of the brain, even to one of them, or to its parenchyma, or to any portion of it, yet it is not always thus restricted to particular parts, and the different forms have much in common. The general term inflammation of the brain is used when any part of the encephalon is involved in this diseased process. Such inflammation may be acute or chronic, general or partial, eongestive, effusive, depositive, adhesive, or suppurative. It may be non-specific or specific, may assume a sthenic or asthenic type, and as anatomical results there may be induration, softening, œdema, dropsy, abscess, neerosis, or gangrene. When it affects the membranes chiefly or exclusively, one, two, or all three of them may be involved. When it is located in the brain substance, the gray or the white matter may be the chief or exclusive seat, it may be above or below the corpus callosum, may be confined to one hemisphere or a part of a hemisphere, or may involve at the same time various parts. From the uncertainty as to the location of many special functions, and the sympathetic relations of different parts, the limits of the disease cannot be accurately defined; nor is this essential to treatment; but an approximate diagnosis as to its locality can often be made from the particular symptomatic phenomena presented.

MENINGITIS.

Inflammation of the membranes of the brain, which this word signifies, may be chiefly situated in the dura mater, in the arachnoid, or in the pia mater. When the dura mater is inflamed the arachnoid is very generally involved also, though the latter may be affected while the former remains free.

Pachymeningitis.—Idiopathic inflammation of the dura mater is rare. It commonly arises from injury, or is secondary to inflammation of the ear or the bones of the skull, of the socket of the eye, or of the scalp.

According to Virchow, either the external or the internal surface of the dura mater may be inflamed, constituting two forms of pachymeningitis. The *external* is nearly always traumatic or secondary to inflammations of the scalp or proximate parts, or to caries or necrosis of the bones.

Morbid Anatomy.—The *anatomical lesions* vary from simple

hyperæmic blushes or rosettes upon the surface of the membrane, to ecchymosis, infiltration, softening, and suppuration of its tissue.

In disease of the skull, pus may accumulate between the membrane and the bone, separating their connections and inducing necrosis. The inflammation may extend to the sinuses, and to all the other membranes, causing general meningitis.

In chronic forms the dura mater becomes thickened, firmly adherent to the skull, and the new false membrane may be transformed into osseous matter.

Causes and Phenomena.—Rarely external pachymeningitis is caused by syphilis, rheumatism, or erysipelas. It may oftener follow thrombosis and suppuration of the sinuses. It has been found to occur in some cases of insanity; but it is more frequently caused by injuries of the skull or cervical vertebræ, or by caries of the internal ear.

A blow upon the head may cause at first partial or complete insensibility, from which, however, the person recovers. After some days, pain and injection of the eyes, flushed face, heat of the head, rigors, nausea, vomiting, and general fever occur; and later, delirium, convulsions, coma, and death may supervene. In such a case the more marked lesions will be present. The dura mater may be separated from the skull, the arachnoid surface will be inflamed, serous, plastic, or purulent exudations will be present, and not only the arachnoid will be involved, but often the pia mater and surface of the brain.

Some cases are more protracted, and a variety of symptoms may occur. Hemiplegia from pressure, or effusion and irritation may take place; there may be facial paralysis, recurrent rigors, variable fever, sometimes with but slight local symptoms, but generally there is pain where the membranes or surface of the brain are affected. At length there will be slowing of the pulse, or great irregularities, various paralyses and signs of compression and suppuration, and at length coma and death.

When the disease is secondary to internal otitis, as is not unfrequent in children, the petrous portion of the skull is apt to be carious; and occasionally disease of the ethmoid, or in the orbit, is followed by these results.

Recovery is possible, but these cases are very often fatal.

Internal Pachymeningitis sometimes occurs. It is nearly always chronic, is chiefly in old persons, is oftener in men than in women, and more frequently than otherwise is caused by chronic alcoholism. It has been produced experimentally in dogs by prolonged poisoning with alcohol. It may occur from other causes, and is secondary to other diseases, acute and chronic.

Morbid Anatomy.—The pathological changes from the long continuance of the disease are marked. The internal surface of the membrane is covered with a yellowish exudation, is ecchymosed, or a layer of dense fibrine is present. This may become organized by the production of numerous vessels within it, and numerous layers may be formed in the protracted cases. Hemorrhages are apt to take place from the great vascularity of the membrane, producing hæmatomata of the dura mater. Cysts form containing blood or serous fluid in varying proportions, mostly found near the vertex. The brain is compressed by these hæmatomata, and anæmia, atrophy, softening, with thickening of the membranes, follow.

Symptoms.—The symptoms in the acute inflammatory period may resemble those of ordinary meningitis. When the disease comes on slowly they may be more obscure. As it progresses, periodical headaches, often limited to one side, and gradually becoming intense, weakness of memory, apathy, somnolence, delirium, slow or irregular pulse, loss of appetite, constipation, clasping of the hands to the affected part, etc., will occur.

The disease may be slow in its progress, going on for weeks and months with less intense symptoms for a time, and these may remit, furnishing delusive hopes of recovery. But dull headache, weakness and disturbance of intellect, feebleness of limbs, and an unsteady gait, imperfect and incoherent speech, and failure of nutrition, will indicate the progress of the disease.

Prognosis.—Recovery is possible after the disease has made considerable progress, as has been proved by clinical observations, and by finding evidence of repair where patients have died long after of other diseases. The disease, however, is commonly progressive and fatal. Failure of mental and physical powers, paralysis, or apoplectic attacks occur, and the termination may be sudden or more lingering.

The *Sinuses* of the dura mater, receiving blood from various sources, are apt to be secondarily diseased. In disease of the membranes, of the brain itself, of the internal ear, of the bones of the skull, and in cases of pyæmia, from whatever sources, the sinuses are apt to suffer from contaminated blood. Inflammations of the walls, with infiltration and exudations of pus, give rise to the formation of clots, the disease may extend to other veins, and serious consequences may follow.

The *symptoms* often present a typhoidal character. There are pain, fever, delirium, drowsiness, vomiting, etc., and when there are discharges from the ear, the diagnosis of inflammation of the dura mater or its sinuses may be made. When the seat of the disease is in the transverse sinus it is apt to extend to the mastoid process, and an

œdematous swelling behind the ear is likely to be seen. When there is phlebitis there is high fever and the suffering is severe.

The *prognosis* in these cases is grave, though recovery may take place. The obstruction of circulation may be serious, the inflammation is likely to extend, capillary hemorrhages may occur, and, in cachectic cases especially, fatal results follow.

New growths may take place in the dura mater—epithelial tumors, osteoma, syphiloma, cancer, etc.—presenting symptoms more or less grave, but difficult of precise diagnosis during life.

TREATMENT OF DISEASES OF THE DURA MATER.

Inflammation of this membrane, when recent and active, must be treated like other acute inflammations.

At the first evidences of an attack there must be absolute rest, with a restricted diet, and prompt antiphlogistic remedies must be used. Cold to the head and neck, venesection in suitable cases, leeches to the mastoid processes, active derivative cathartics, sedatives, and diaphoretics are the chief agents to be employed. When the inflammation is due to an internal otitis, with discharges from the ear, tepid injections and poultices will be required; and when the pain is severe, anodynes may be added, and depleting and revulsive measures must be used, adapted to the general condition.

In the chronic cases of internal pachymeningitis the cause must be removed, the use of alcoholics prevented, local depletion, counter-irritation, and derivatives should be used in the earlier stages, and means for promoting absorption—*iodides*, etc.—later will be called for. The persistent use of iodide of potassium, to which may be added ergot, will often be required. Bromide of potassium, both in the acute and subacute stages, may be of use; rest is an important element in the management, and all hygienic rules must be observed.

In thrombosis of the sinuses rest must be enjoined, and symptomatic treatment instituted. Much cannot be hoped for from any specific medication, but palliative measures should not be neglected.

ACUTE MENINGITIS.

This designation is commonly applied to acute inflammation of the arachnoid and pia mater. Either of these membranes may be alone or chiefly diseased, though usually both are affected at the same time.

Morbid Anatomy.—Recent inflammation of the arachnoid

membrane may present anatomically a thin layer of gelatinous-looking substance through its transparent tissue, but when the membrane is punctured a fluid discharge occurs and the appearance vanishes. An appearance somewhat resembling this may occur where no inflammation has existed. In other cases the arachnoid becomes opaque, and beneath it false membrane is deposited. Common exudation matter, mingled with serum and pus, will often be found. The pia mater is generally involved more or less, while both membranes will be vascular and thickened, and inflammatory exudates will be found between them. The surface of the brain will generally be more or less hyperæmic. The lesion is oftenest upon the convexity of the hemispheres, but any part may be involved. The exudation is yellowish and thick, and often fills the subarachnoid space, and is apt to be more abundant along the vessels. These products may follow the fissure to the base, and the disease becomes very general over the membranes.

In severe cases the cortical substance is not only hyperæmic but softened and infiltrated with pus. Capillary hemorrhages are not unfrequent, and there are often firm adhesions between the pia mater and the brain substance.

In *Chronic Meningitis* there are found thickening and fibrous changes of the arachnoid and pia mater, and adhesions, more or less extensive, to the reddened cortex. Atrophy of the cortical substance may follow, and sometimes of the whole brain, the ventricles being dilated and filled with serum.

Etiology.—*Simple Primary Meningitis*, exclusive of epidemic cerebro-spinal meningitis, is not a frequent disease, and occurs oftener in children than adults, though it may occur at any age. The chronic forms are more frequent in advanced life, and from causes similar to those which produce chronic inflammation of the dura mater. The acute forms occur often as the result of traumatic injuries, sometimes from sunstroke, and from violent excitement.

Secondary forms may result from extension of the inflammation from the dura mater and the sinuses, from caries of the bones, from internal otitis, from disease of the eyeballs, and from erysipelas, syphilis, and Bright's disease; and the disease may occur in connection with various other affections.

Symptomatology.—Three stages, from the character of the symptoms, are sometimes made. First, a stage of excitement or irritation; second, a stage of delirium; and third, a stage of stupor, depression, or coma.

There are, however, great varieties in the symptoms and course

of the disease. The early symptoms are sometimes obscure. Usually the patient first complains of a sense of discomfort, then of headache, sometimes only moderate, but generally in the course of a day or two it is severe. There are contractions of the brows, sensibility to light and sound, and vomiting occurring suddenly and often without preceding nausea. There will be scanty urine, constipation of the bowels, and a degree of fever, varying, however, in intensity and duration. In children there is rolling of the head on the pillow, with sudden shrill cries, raising of the hand to the head, tossing motions, a variable pulse, often convulsions, paralysis, profound coma, and death. There is often great variableness of symptoms. The pulse may be very rapid or very slow, and it often varies from time to time. Rosenthal states that, "from clinical observations and the results of autopsies, the fever is found to correspond to the intensity and extension of the exudative process, and the variations of the pulse correspond with analogous variations of temperature and respiration ;" but in my experience, no such uniformity of correspondence has been observed. In cases where the early symptoms are obscure, especially in children, staggering and stumbling, or a sense of falling may be first noticed. The appetite may be good, but careful observation will detect some heat of the head, and slight general elevation of temperature, with starting in the sleep and some general derangement. These obscure symptoms may continue from a few days to two weeks, or possibly longer. If an early diagnosis is made and treatment is promptly instituted, recovery may take place.

In ordinary cases the intellectual faculties are more or less disturbed from the beginning. There is restlessness, irritability, slowness of ideas, difficulty of speech, and a tendency to apathy, somnolence, and delirium. Often active delirium occurs after the first two days, and continues until the stage of somnolence and coma sets in. The pupils, contracted at first, become dilated in the stage of coma and collapse, though sometimes they remain without material change. Sometimes there is a characteristic cutaneous hyperæsthesia; and increased reflex excitability may sometimes be observed in the stage of coma. Erythematous spots sometimes occur, and often only a light touch will cause a redness of the skin, which remains for a considerable time. Various muscles of the trunk and the limbs are spasmodically contracted, paroxysmally or more permanently; and in children general convulsions are common. In the effusive stage, with increase of cerebral pressure, paralysis is common, often local, but not unfrequently hemiplegic. In the latter cases there is apt to be cerebral œdema.

Though in some cases there is great variableness of the pulse, in

most it is rapid in the outset, but more irregular afterward, being slow often when there is cerebral pressure, but sometimes becoming extremely rapid at the last. The respirations are variable, but in some cases are very much accelerated toward the last. The advanced stage will often resemble that of the latter stages of typhus. Great muscular prostration, stertorous breathing, and involuntary passages from the bowels and bladder, indicate a speedy termination.

The *Duration* of the disease varies much. In slighter cases, where, however, the diagnosis will be more or less doubtful (indeed the line between irritation, congestion, and inflammation cannot always be drawn), the improvement may be speedy and recovery complete. In the unfavorable cases death is sometimes speedy—within a very few days—while in other cases as many weeks, or even a few months, may elapse, the meningitis becoming chronic. In some rare cases, when most of the other symptoms improve, there may be progressive emaciation, and death at length occurs.

Diagnosis and Prognosis.—When the initial symptoms are not well marked, the diagnosis will be uncertain for some time. But the sudden appearance of severe cerebral symptoms in the midst of health, or as the result of injuries, or in diseases of the cranial bones, will render an early diagnosis possible. Sometimes violent symptoms undergo speedy retrocession.

Simple meningitis may be confounded with the tubercular variety, so common in children. This will be referred to farther on. Meningitis should be distinguished from the early stage of fevers, and the initiatory fever of small-pox is more likely to be mistaken for it than that of other diseases. But in small-pox there is more pain in the back than in meningitis, and the appearance of the eruption will clear up the case. The occurrence of meningitis during the progress of essential fevers presents difficulties of diagnosis. But when cerebral symptoms of a severe character occur in the early stage of these diseases, meningitis may be suspected.

Cerebral hyperæmia presents symptoms much resembling those of meningitis, but the premonitory mental symptoms in hyperæmia are less marked, there is not the rapid increase of fever nor the initiatory chill, there are not as likely to be convulsive movements nor distortions of features, and coma and paralysis are much more rare.

Rheumatic meningitis will be distinguished from the ordinary forms by the mode of onset and by the arthritic inflammations.

The eclampsia of children will be distinguished from meningitis by the suddenness of their occurrence, their shorter duration, the more complete remission of the symptoms, and the usual speedy recovery. The existence of some form of irritation in other parts of

the body, as a cause of the convulsions, must be taken into the account.

Acute inflammation of the labyrinth of the ear will sometimes present many of the symptoms of meningitis. But the pain will at first be unilateral, the symptoms are usually developed rapidly, there is a loss of hearing in the affected ear, and, when both are attacked, deaf-mutism often follows.

There should not be great difficulty in distinguishing meningitis from the delirium of debility and inanition, from the exhaustion of diarrhœa, from mania a potu, or from blood poisoning. The history of the case and the general condition of the patient will aid the diagnosis, and the fullness or depression of the fontanels will afford evidence in the case of children. Great care, however, will often be necessary, in all these cases, to avoid mistakes.

Inflammations of the membranes and of the brain substance are so often combined, and inflammations of different parts of the encephalon have so much in common, that an account of *cerebritis* and *encephalitis* will be given before the subject of treatment is considered.

CEREBRITIS AND ENCEPHALITIS.

Cerebritis is inflammation of the brain substance, while the term *Encephalitis* signifies an inflammation of several parts of the contents of the cranium. The term *Cerebellitis* is applied to inflammation of the cerebellum.

Inflammation of the brain is seldom general, but is more or less confined to particular parts. Should the whole brain tissue be attacked, death would doubtless occur before the full development of the inflammatory process.

Morbid Anatomy.—Anatomically it exists, therefore, in circumscribed parts. It may be in the superficial layers, or in the deeper structures of the cerebrum or the cerebellum. These inflamed patches are of various dimensions, and are more frequent in the gray matter of the cortex and the cerebral ganglia than in the white substance.

“If the foci are large, the cerebral substance is infiltrated with fluid, softened, swollen, and strewn with red spots, and capillary hemorrhages; the convolutions are flattened and the surrounding cerebral parenchyma and the meninges are dry and anæmic.” (Rosenthal.) The nerve cells undergo various degenerative changes, often of a fatty character; infiltration with serum and pus will produce softening, and frequently the reduction of the part involved to the consistence of a creamy fluid; and some of the slower inflammatory

processes result in hyperplasia of the connective tissue and hardening of the parts which are implicated. Within the inflamed and about the softened part there is capillary congestion, which causes the white substance to be grayish red, while the gray substance may be whiter than usual. The vascular sheaths and the capillaries may undergo fatty degeneration, the vessels then are unequally dilated, and are sometimes obstructed. Although there is increased vascularity in inflammatory softening, Virchow is of the opinion that this may disappear post mortem, so that the absence of the red color does not prove conclusively that the softening is not inflammatory. It is possible that there is often anæmia of the softening part, where an inflammatory process was nevertheless at the origin of the change. Softening, however, sometimes results from cutting off the circulation, and from anæmia arising from different causes, and these different conditions are not always readily distinguishable.

Several *pathological forms* of cerebritis may be distinguished. In some, exudation of serum and corpuscular matter takes place, inducing more or less softening with an appearance of œdema constituting an *œdematous form*. In others, pus corpuscles are freely exuded, constituting a *suppurative form*. These varieties are usually acute, though occasionally chronic. There is a *hyperplastic form*, where there are corpuscular and fibrinous elements effused, with increase of connective tissue, which runs a subacute course; and lastly there is a *sclerotic form*, in which the nerve and cell elements are transformed into connective tissue—a process which is almost always chronic. Each of these varieties may be more or less circumscribed or diffused, and may be primary, or secondary to some other affection.

When these inflammatory products are absorbed, they, with some of the proper brain tissue, undergo fatty degeneration, as in many other cases where either adventitious or normal elements are absorbed.

When suppuration takes place, the pus more frequently forms in the medullary than in the cortical substance, whether in the cerebral hemispheres or other parts, the surrounding brain tissue is softened and œdematous, and the affected part is more or less completely broken down. The abscess travels, the cortex is often involved; the pus is greenish in color, generally inodorous, but sometimes fetid, and is mingled with the débris of the brain substance. These abscesses are of different sizes, some are very small, and in rare cases they involve almost an entire hemisphere. There may be one or more; and the cerebellum is quite as subject to this form of disease as any other part of the brain.

A cerebral abscess may force its way in different directions, often rupturing into the ventricles, when death soon follows. Rarely it

makes its way to the surface, or ruptures through into the tympanum or nasal fossæ.

In a majority of cases, where life continues a sufficient length of time, cerebral abscesses become encysted. The cyst wall is vascular, at first thin and soft, afterward thicker and more resisting, consisting of two or three layers.

In rare cases the pus may undergo disintegration and become absorbed, and recovery may take place. A partially calcified mass may remain, or absorption may be complete, the cyst wall may be retracted and disappear, and only a scar texture be left. More acute attacks of inflammation are apt to supervene, or the cyst may rupture; and in a large majority of cases where the abscess is of considerable size, death in one way or another is the result.

Different portions of the contents of the cranium—the *encephalon*—the membranes and brain substance, may be simultaneously inflamed.

Various structural changes which have been described may then be found after death; and the phenomena during life will be more violent, and the course of the disease more rapid.

ETIOLOGY OF CEREBRITIS.

Most of the causes producing meningitis will also produce inflammation of the substance of the brain, though internal morbid influences are perhaps more likely to affect the brain substance. Thus fatty and calcareous degenerations of the vessels, the occurrence of emboli, the transportation of septic and infectious matters, toxic agents, the presence of tumors, the occurrence of hemorrhage, syphilitic infections, and all the causes which may produce excessive hyperæmia may produce cerebritis. Excessive mental application may induce irritation and hyperæmia resulting in inflammation. It is sometimes primary and sometimes secondary, and may be produced by different morbid conditions in other parts of the body. It occurs at all ages, in children, adults, and in the aged, and in the latter it is oftenest the result of diseases of the vascular system.

SYMPTOMATIC PHENOMENA.

The symptoms of cerebral inflammation will vary with the severity and extent of the disease, and the particular parts affected. When a large portion of the *encephalon* is involved, a severe train of symptoms, to which the older writers gave the name of *phrenitis*, is produced.

There is apt to be high excitement at first, with violent pain and delirium, a sense of binding constriction, much throbbing and heat of the head, the eyes are injected and wild in expression, are sensitive to the light, and the pupils are contracted; sounds are painful, the pulse hard, the temperature of the whole body is elevated, the tongue white; there are thirst, nausea, and vomiting, often absolute sleeplessness and raving delirium, constipation of bowels and scanty and febrile urine, and sometimes convulsions. It is seldom that all these symptoms are present. Vomiting may be a chief symptom, or severe convulsions may cast others in the shade. There may be loss of speech, or a variety of other "brain symptoms."

A state of excitement in the severer cases may continue from twelve hours to two or three days, when depression or collapse may supervene. Pain may cease, or at least complaint of pain; the delirium becomes low and muttering, the senses become dull and are perverted; there will be deafness or roaring, obscure or double vision, dilated pupils, squinting, twitching of muscles, tremors, paralysis, a ghastly countenance, cold sweats, relaxation of sphincters, involuntary evacuations, coma, and death.

The course may be very rapid, terminating in from twelve to twenty-four hours, or the disease may continue for two or three weeks.

In these cases the *post-mortem* examination will show a variety of the lesions which have been described—hyperæmia, ecchymoses, exudates—serous, plastic, or purulent—infiltrations, softening, etc.

There are other forms of softening not inflammatory—hemorrhagic, fatty, oedematous, mechanical, and putrefactive. These all should be distinguished from inflammatory softening. There will usually be surrounding hyperæmia in the latter, and the microscope will aid in making more positive the distinction. When the characteristic inflammatory exudates, pus and lymph, are detected, the pathological state will be made plain.

In simple cerebritis so violent a train of symptoms very seldom occurs, and such varied and extensive pathological appearances are not found. There will, however, generally be sudden headache, more or less fever, often vomiting, difficulty of speaking, heaviness, moroseness, contracted pupils, formication, sometimes apoplectic stupor, or convulsions.

Active delirium is not as apt to occur as in meningitis, and the intellect in most respects is likely to suffer less. The headache often becomes unilateral, and paralysis (generally local) is not unfrequent.

In some cases the commencement is obscure, and the duration varies from two weeks to two months, and sometimes much longer.

A great variety of particular symptoms are observed, depending chiefly upon the location of the inflammation, and upon its more acute or chronic character. The *paralytic* form varies much in the location and extent of the paralysis. Epileptiform varieties occur, especially in children and women, which may sooner or later result in general paralysis.

The *Psychical Disturbances* vary exceedingly. They may be very slight. An abscess of the brain may present comparatively slight symptoms until a very few days before death. Disorders of motion and sensibility vary greatly. In spontaneous or idiopathic cerebritis, signs of cerebral congestion only—such as moderate pain, some dullness, sleepiness or wakefulness, giddiness and confusion, etc.—may continue long before marked symptoms, such as great embarrassment or loss of speech, local spasms or paralyses, hemiplegia, etc., show more clearly serious lesions of the brain.

In inflammation and abscess of the frontal lobes, there is likely to be frontal headache, disturbance of mental faculties, paresis of the opposite side of the body, and sometimes aphasia. In inflammation of the walls of the Sylvian fissure, or of their courses of communication with the frontal and parietal regions, *aphasia* is a common and striking symptom. When an inflammation is situated in the *motor ganglia*, disorders of *intelligence* and *contractures* occur, followed by *paralysis of one half of the face and body*. When the *tubercula quadrigemina* are the seat, amaurosis occurs. Inflammation of the *cerebral peduncle* causes paralysis of the *oculo-motor* nerve of the *same* side, but motor disorders of the limbs on the *opposite* side of the body, and disturbance of vision also from involvement of the root of the optic nerves. The *pons Varolii* is said to be but rarely inflamed. It, however, undergoes softening from atheroma and obliteration of the basilar artery, when hemiplegia of motion and sensation, either of a sudden apoplectic character, or of a slow course, with dilatation of the pupils and difficulty of speech and respiration results. In inflammation of the *cerebellum*, occipital pain, uncertainty of movements, vomiting, rigidity of the muscles of the neck, and general convulsions are apt to occur. Stiffness of the muscles of the neck is said to indicate abscess in the cerebellum.

Although the correspondences of these symptoms and the localizations are presumptively correct, they are not altogether reliable, and more observations, clinical and post mortem, are required for their complete establishment.

When an acute cerebral inflammation terminating in an abscess occurs, complete recovery is an exceedingly unusual event. Even when improvement takes place and life is continued, the functions of

the part involved are not entirely restored. In the more chronic cases, with the other pathological changes which have been described, more or less impairment occurs where death does not take place.

The **Prognosis** of cerebral inflammation, when it is fully established and to any considerable extent advanced, is unfavorable. The usual termination is in death. This may be caused by the extension of the lesion until it directly involves portions of the brain whose functions are essential to life, or by compression and anæmia of such parts, by the size of an abscess or an œdematous swelling, by complications of meningitis and effusions of serum, by hemorrhage, by the opening of an abscess into the ventricles or between the membranes, by the sympathetic effects of the disease upon other parts of the brain more essential to life, or by hypostatic congestions, gangrenous bed-sores, or by impairment of functions in other organs of the body.

In acute cases death usually occurs in from one to four weeks.

Diagnosis.—It is often a matter of the greatest difficulty to distinguish inflammation of the substance of the brain from that of the meninges. There are usually at the onset a higher fever and more violent irritative symptoms, and more extensive disturbance of the functions of both sides of the body in meningitis. Cerebritis is more localized, there is less fever, and often there is an early appearance of limited convulsions, contractures, and paralyses. It is also sometimes difficult to distinguish the cerebral hemorrhage which precedes from that which follows or accompanies cerebritis. But in primary hemorrhage the symptoms come on more suddenly, are most violent at first and become less so afterward, while in the capillary hemorrhages accompanying cerebritis the symptoms are less marked at first, and increase afterward. In cerebritis the loss of consciousness is usually less perfect than in hemorrhages; limited convulsions and contractures are more common, and paralysis is less complete, extensive, and persistent. In cerebral inflammation the pulse is often irregular, cutaneous hyperæsthesia is often present, while in apoplexy the pulse is usually slow and regular, and anæsthesia is more likely to occur. Cerebritis often follows apoplexy, when its proper symptoms will be developed.

In *tumors* of the brain, as well as in abscess, signs of compression are often present, and inflammation in surrounding tissues may be induced. But the early symptoms in tumors are more obscure, they come on more slowly, are usually more intermitting, are attended with less fever, and the usual causes of inflammation are absent.

Meningo-encephalitis following otitis usually terminates rapidly in death, and when improvement takes place, fatal relapses are apt to occur.

TREATMENT OF ACUTE MENINGITIS, CEREBRITIS, AND ENCEPHALITIS.

The indications in these different forms of inflammation within the cranium are so similar, and the cases are so often complicated, that the treatment may be considered together.

On the first appearance of symptoms, absolute rest and quiet, comparative darkness, and a low diet should be enjoined. The head should be elevated, and cold to the whole head and neck should be steadily applied. If the extremities are inclined to be cold, warmth, mustard pediluvia, and sinapisms should be applied. In extreme cases a cold douche to the head, in a strong and not very impressible person, may be used, followed by the steady application of the ice cap. To render the application of cold more effectual, the hair should be cut short, but the head need not be shaved.

The question of bleeding will at once arise. If the patient has previously been well nourished, and especially if he be inclined to plethora, if the pulse be full and strong, the carotids tense and throbbing, the eyes injected, and the heat of the head inclined to be great, there can be no doubt of the propriety of letting blood. The quantity to be taken, and the manner of taking it, must depend upon the general condition of the patient and the character of the symptoms. One or more venesections, drawing blood to the extent of impressing the general circulation, should be practiced.

This may be followed by leeching or cupping, as the conditions may indicate. It is impossible to lay down any fixed rules for the use and extent of this remedy. When the blood pressure is great, and the chief danger is in this and the exudates it is likely to induce, the indication is to diminish pressure, and no other measure is so prompt and efficient as taking blood. But there is another danger, namely, that of shock and depression. When this is present and predominant, and not dependent upon the blood pressure, when the heart is feeble in its action, and especially if the quantity of blood in the system be small or it be poor in quality, bleeding should be avoided. I have witnessed sudden collapse and rapid sinking after a bleeding in cerebral inflammation; but, on the other hand, have seen relief and improvement after the use of the measure. It must be practiced with caution and discrimination, and often local bleeding will be safer than general, and quite as efficient.

As a means of diminishing blood pressure in the head, and lessening the danger of effusion, revulsive cathartics must not be neglected. Calomel and jalap, seuna and a saline, a saline after a mercurial, etc., should be used and repeated, as may be required or borne. Diuretics, particularly at a somewhat later period, and diaphoretics eliminate

watery materials and tend to prevent serous effusions into the ventricles, between the membranes, or into the substance of the brain.

Dropsy and œdema are among the chief sources of danger. Counter-irritation by means of blisters tends to the same result, of preventing or removing these conditions. They may be applied to the nape of the neck or to more distant parts, and are more particularly indicated after the first stage of excitement has passed. When the action of the heart is excessive, as an aid to or substitute for bleeding, *veratrum viride* or *aconite*, in sedative doses, would seem to be indicated.

Another class of agents has the reputation, and I think the effect, of causing contraction of the vessels and diminishing the blood pressure in the brain. They are the bromides, hydrocyanic acid, and ergot. The bromides not only diminish the vascularity of the brain, but they allay excitement, soothe irritation, and tend to procure rest of the organ. The bromide of potassium or of sodium may be given in doses of a scruple or more once in from four to six hours, and often with marked benefit.

The bromide of ammonium, in somewhat smaller doses, and the hydrobromic acid are thought to have a similar effect; but my experience in these cases has been with the two first-named salts. The fluid extract of ergot, in doses of from forty to sixty minims three or four times a day, has a reputation, especially in the subacute forms of the disease. When there is great cerebral excitement which is not controlled by these remedies, belladonna or its derivative atropine, or hyoscyamus, might be tried. Chloral hydrate in sufficient doses to enforce rest may be beneficial, but care should be observed in its use, as markedly depressing effects sometimes follow its free administration. It is, however, among the remedies to be cautiously resorted to where continued sleeplessness and raving excitement are not overcome by less powerful means. Should the general temperature be excessive, a full-length bath or a pack should be used, as in other cases of hyperpyrexia. These remedies are sometimes very soothing. Opium is by many regarded as contra-indicated in hyperæmia and inflammation of the brain, but the justness of this opinion is not demonstrated. There are cases of intense erethism and excitement of the brain, not so much from hyperæmia as from irritation of the cells, where a full dose of morphine produces the most beneficial effects. Perhaps a combination of morphine and atropine would be still more efficient. Hyoscyamin alone or combined with chloral hydrate is often very efficient in allaying cerebral excitement.

The iodide of potassium in very free doses, especially after the first period of excitement is passed, and when effusions are threatened or

have occurred, is, in my estimation, a remedy in meningitis of the greatest value. The unequivocal cases which I have known to recover after symptoms of effusion have occurred, have been under the use of this remedy. Drs. Flint, Alouzo Clark, and many others speak of it in very high terms, and my experience with this article in meningitis, both simple and tubercular, has placed it, in my estimation, beyond any other remedy in the second stage of the disease. It may be given in doses of from ten to thirty grains once in four or six hours, and persevered in, if well borne, as long as there is severe disease or any hope.

The most remarkable cases of recovery I have ever witnessed have been where very small doses of mercury were given alternately with the iodide of potassium. Doubtless the iodide of mercury was formed, but the mercury was not given in sufficient quantity to produce an overdose of this active form of the remedy.

In the later stages of the disease, when the excitement is past and the stage of depression has arrived, depleting measures must be discontinued and the heart's action kept up, if possible, by nutritious foods and proper stimulants. When the tendency to death is from coma, the prognosis is bad, and the only hope is from the removal of exudates and the relief of the pressure. When the tendency to death is from asthenia, supporting measures, food, and perhaps stimulants may bring the patient through. Attention to the bladder is important in all cases.

The preceding remarks on treatment are intended more particularly for meningitis, but in the main will apply to encephalitis as well.

When an acute inflammation is mainly in the brain substance with a tendency to the formation of an abscess, some modification of treatment may be required. Bartholow advises, in the earlier stages of the inflammation, the same active measures to prevent the extension of mischief as in acute meningitis; but says, "Ergot, quinia, and chloride of barium (liq. barii chloridi, ℥xx every four hours) are the most efficient means of preventing the migration of the white corpuseles and the diapedesis of the red. When suppuration occurs, it is good practice to check the formation of pus and the collateral œdema and hyperæmia by full doses of quinine." (Practice, p. 532.) Of the effect of quinine in tending to produce these results in most tissues of the body, I have no doubt, from sufficient experience. Of its effects in suppurative inflammation of the brain I cannot speak in the same manner from experience. Quinine is generally thought to increase the blood-flow to the brain, and it certainly often causes unpleasant sensations in that organ—roaring in the ears, sense of stricture, confusion, even delirious excitement, etc.; but whether by producing congestion or not may be doubtful. It would be very difficult

to demonstrate that in an abscess of this organ full doses of quinine did "check the formation of pus, and the collateral œdema and hyperæmia." It would require observation in a large number of cases, such as few have had. This practice, then, cannot be regarded as settled; and while I am very far from condemning it, I scarcely feel authorized to positively advise it. I have in a few instances thought the brain was decidedly disturbed by quinine, and have feared that more than slight and transient brain symptoms were produced by it when given largely in inflammations of other organs. These cases have been very few compared with those where no such results have followed these free doses, and the effects in the few may have been due to other causes; but further experience seems to be required before this treatment can be spoken of with confidence. Should, however, free doses of quinine be given without increasing cerebral symptoms, I should hope for beneficial effects from its use.

In cases of abscess of the brain connected with otitis, boring through the petrous portion of the skull has been advised; and it may be practiced where the evidences of the presence of an abscess are sufficiently clear, where the brain was previously healthy, where the patient is vigorous, and the symptoms are of a severe character threatening a speedily fatal result without such interference. Relief has been obtained by this operation in some cases.

In the *Subacute* and *Chronic* forms of meningitis and cerebritis, where in the one case false membrane is exudated, the meninges are thickened or serum is effused, or in the other where increase of connective tissue, atrophy of brain cells and tubes, and sclerosis occur, a modified course of treatment will be required. The indications are to arrest the slow inflammatory changes, to cause absorption of the exudates, and to palliate the symptoms. As in cases of such inflammatory processes with exudations and hyperplasias in other tissues, iodide of potassium in long-continued doses stands at the head of remedial measures. Small but repeated doses of mercurials, as the twentieth or fortieth of a grain of the bichloride, or a somewhat larger dose of the iodide of mercury, two or three times a day, may be indicated. The bowels must be kept open, proper hygienic regulations observed, and counter-irritation may aid the effects of these remedies. The bromide of potassium or sodium, and the ergot, may be used when hyperæmia and excitement are present. Dr. Flint has seen benefit from phosphide of zinc, and Dr. Hammond from chloride of barium, and others have strongly recommended nitrate of silver, and these remedies may be worthy of further trial. When the bichloride of mercury is long used, as is sometimes advisable in cerebral sclerosis, tonics may often be combined with advantage.

Unfortunately in many cases of chronic sclerosis the early symptoms are so obscure as to elude detection ; and when the disease is advanced, all treatment generally fails. The structural change when fully inaugurated, and especially when it is diffused, or when there are many foci of the disease, is usually progressive, the symptoms become more and more grave, presenting great varieties according to the location and extent of the lesions, and death is the ultimate result. If no intercurrent affection terminates the case earlier, the disease may continue from two or three to eight or ten years.

Meningitis and cerebritis are occasionally *secondary* to other diseases. Thus they may occur in *rheumatism*, in *erysipelas*, and in various febrile affections. Trousseau has described several forms of cerebral rheumatism—in some there is coma without paralysis, in others delirium followed by coma, and in others still, pain in the head, delirium, etc., without coma. Symptoms of brain disturbance may occur in rheumatism, especially where endocarditis appears as a connecting link, by disturbed cerebral circulation, by vitiated blood, or by emboli plugging the small arteries.

The *Treatment* of rheumatic meningitis or encephalitis should be similar to that of rheumatism of the joints, modified somewhat by the cerebral symptoms. In connection with proper revulsives, the salicylic acid, salicine, or salicylate of soda, alkalies, blisters to the nape of the neck or behind the ears, etc., will be required.

Erysipelatous Meningitis is usually a violent and rapidly fatal form of disease, and the treatment is not well established. Quinine, tincture of iron, and counter-irritation have been used, and in the early stage free sweating with jaborandi would be suggested.

In meningeal or cerebral inflammations accompanying fevers, cold applications to the head, revulsive measures, etc., should be used, but the treatment applicable to the fever will be required.

In all cases where there is a state of hyperpyrexia, the cool bath should be used in connection with other antipyretic measures. It should be borne in mind that severe brain symptoms in fevers are not always, or even often, produced by cerebral inflammation.

ACUTE TUBERCULAR MENINGITIS.—GRANULAR MENINGITIS.—BASILAR MENINGITIS.

An inflammation of the membranes of the brain, more frequently at its base, with granular deposits in the tissue of the membrane, gen-

erally regarded as miliary tubercles; is known by these several names. It is generally a primary affection, but is sometimes secondary, or at least it occurs at the same time with tuberculous disease in the thorax or abdomen. It is much more frequent in children than in adults, and from the frequent effusion of serum into the ventricles, or between the membranes of the brain, and from the suddenness with which grave symptoms often come on, it has been called *water-stroke*.

Symptoms.—This form of meningitis, though usually situated at the base of the brain, may be chiefly at the vertex, and the symptoms differ as the location is in one part or the other. When it is at the base there is more vomiting, with constipation, irregular and infrequent pulse, unequal pupils, and strabismus. When at the vertex, there are thought to be more convulsions and tremors, twitchings of limbs and muscles of the face, grasping of the thumbs in the clinched fist, and frequent pulse.

The symptoms, however, vary in both forms, and generally at first are remarkably obscure.

The child, before the more marked symptoms appear, will be in ill health, restless and variable, starting in sleep, will have slight elevation of temperature, loss of weight, constipation, fear of falling, will be unwilling to be left alone, or sometimes will seek seclusion and fall asleep in the daytime; there will sometimes be temporary loss of muscular control, aversion to mental application, commonly more or less headache, etc.

When a more decided development of the disease occurs, there will be increase of headache, decided rise of temperature, and *vomiting*.

This latter symptom is one of the most characteristic and important, when accidental irritations of the stomach from improper ingesta, and when inflammation of that organ and other apparent causes are excluded. Next in time and importance are convulsions. These often occur at the same time with the vomiting. The temperature may rise to 105° F., but it is very variable in amount and continuance. The patient is apt to be delirious, especially at night; restlessness is continuous; the pulse varies, but is often rapid; there is tossing, rolling of the head, shrieking and moaning; the bowels remain constipated and the appetite fails. This stage lasts a few days, when unequally dilated pupils, strabismus, and other evidences of local perversions are usually present. A few days later the excited condition is replaced by one of depression and stupidity. There is now scarcely any recognition of surrounding objects; one or both pupils may be widely dilated, the breathing is often irregular,

there is sometimes low moaning or sighing; the pulse may be very rapid or quite low, and often varies markedly from time to time; the temperature may be very high, but it is not uniform; the abdomen is retracted, the finger-nail drawn across the skin generally leaves a vivid red mark lasting some little time, subsultus tendinum is likely to be observed, the face has a worn and pinched expression, there is sometimes picking of the bedclothes, tossing of the hands to the head, the pulse becomes small and variable in frequency, coma becomes more profound, involuntary evacuations occur, there is loss of sensation and reflex action, convulsions may be repeated, hemiplegia is often discovered, the eyes become fixed and glassy, and death from coma supervenes. After active symptoms are observed the disease seldom continues more than fifteen or twenty days, and sometimes not more than a week. Indeed in exceptional cases very marked symptoms may not occur until convulsions, followed by paralysis and coma, speedily result in death.

A variety of symptoms is often present to fill up the outline which has been sketched; but with this variety there is a constancy of general characteristics which to an experienced observer renders the diagnosis unmistakable as the disease advances.

The **Pathology** and **Morbid Anatomy** are worthy of attention.

Tubercular meningitis attacks children much more frequently, and is more fully described in works upon their diseases. It is not, however, confined to childhood. It may occur at any age in tuberculous persons, and I have not unfrequently witnessed it in adolescents and in early adult life. It is much more frequent in delicate tuberculous children than in others, though it sometimes attacks children apparently robust. The local attack is perhaps more frequently in that portion of the pia mater covering the fossa of Sylvius and the under surface of the cerebellum, but not unfrequently it has its chief seat in other situations, not as frequently, however, upon the convexity as the base of the brain. There is hyperæmia of the membrane more or less marked, though when free effusion has existed for some time the membranes may appear comparatively pale and sodden. Small grayish-white or yellowish granulations are seen in the course of the small arteries of the pia mater. They are usually about the size of a millet seed; but several may unite, forming little masses of larger size, and some are so small as to be seen only by a magnifying power. They are sometimes so small and scattered as to require careful searching to detect them, while at others they are larger, abundant, and readily seen. Not unfrequently a fibrino-purulent exudation is found, but sometimes the evidences of inflammation are

very slight where the granular deposits are abundant. Whether inflammation or the deposits are first in the morbid process is perhaps not determined; but both are present in the course of the disease, though in different proportions in different cases. The symptoms are much the same, whichever most prevails. In a large proportion of cases (about seventy-five per cent.) the ventricles are filled with a free quantity of serous fluid, sometimes clear, and at others turbid with pus or other inflammatory elements. From the frequency of these effusions the disease was formerly called acute hydrocephalus, or water-stroke. When the effusion is large the brain is compressed and flattened, and the portion surrounding the effusion is often greatly softened and almost diffuent. This is thought to largely occur post mortem, but a change approaching this state must occur before death. Minute blood points are sometimes found in the substance of the brain, but oftener in the pia mater; and small clots will sometimes be found in the vessels, obstructing the blood flow.

A microscopic examination of these granular masses shows an accumulation of lymphoid cells in the walls, and in the surrounding sheaths of the small arteries of the pia mater; but the characteristic tubercular *giant cells* are less common than in ordinary tubercles elsewhere; and caseous metamorphosis of the centre of the masses is less frequent than in other tuberculous deposits. Some have questioned the genuine tuberculous character of these deposits, but most modern pathologists regard them as tubercles; and this view is strengthened by the fact that very generally, or at least very often, tuberculous inflammation and tubercles are found in other situations in the body—in the lungs, lymphatic glands, or elsewhere. The pia mater of the spinal cord has often been found to be affected as well as the cerebral membrane, and in some cases the ophthalmoscope has shown tubercles in the choroid coat of the eye during life. Neuro-retinitis and serous infiltration of the sheath of the optic nerve have been observed, probably as the result of intracranial pressure. Any of these appearances clinically observed are of diagnostic value.

Diagnosis.—The diagnosis of Tubercular Meningitis, especially in its earlier stages, is by no means always easy. It is to be distinguished from essential fevers, with which it is sometimes confounded. But in fevers there is not the same sensibility to light, there are not the same lancinating pains causing the fitful shrieks, there is an absence of strabismus, of affections of the pupils, and of various other characteristic symptoms; and there are the history and the characteristic symptoms of the particular fevers. It is exceedingly important to distinguish it from the *hydrocephaloid affections*, the result of exhausting diarrhoea, and of other forms of inanition. There is often a

striking resemblance in the stupor and coma in the two affections, but the preceding histories are different, the fontanels are in an opposite state, and in hydrocephaloid cases there is an absence of many of the particular symptoms which have been described as characteristic of meningitis.

It is sometimes exceedingly difficult, if not impossible, to distinguish tubercular from simple meningitis. The access of the tuberculous form is, however, more gradual, there is usually evidence of the tuberculous diathesis, and often the presence of tubercles elsewhere, and it is not as likely to be the result of traumatic injuries. If by an examination with the ophthalmoscope tuberculous deposits are found in the eye, the diagnosis would be clear, but the absence of such discovery would not exclude tuberculous meningitis.

Prognosis.—The prognosis in tuberculous meningitis, when the diagnosis is clear, is very bad. It is difficult to say whether genuine cases have recovered. Still there are occasional instances of recovery in cases where all the essential symptoms are present which have marked those cases which post-mortem examinations have proved to be tuberculous. In the uncertainty of distinguishing tuberculous from simple meningitis, and in the hope that even the former, in rare cases, may terminate favorably, prompt treatment is called for.

Treatment.—This will not materially differ from that which was advised in acute simple meningitis. In the early stage, derivative cathartics, as the strength will bear, cold to the head, and sometimes leeches behind the ears, bromide of potassium, and perhaps fluid extract of ergot, and soon the free use of iodide of potassium should be resorted to. These means afford the greatest prospect of relief. I have seen cases recover under the free use of the iodide of potassium where I had no doubt of the existence of tuberculous meningitis, and where I had scarcely less doubt, before commencing its use, of a fatal termination. It is impossible to demonstrate the fact, in such cases, of the tuberculous character of the disease; but experience has taught me that scarcely any case is so desperate as to exclude all hope. In protracted cases supporting measures will be called for, and soothing remedies will be indicated where the sufferings are great.

When evidences of effusions appear, diuretics and a dry diet are suggested. Blisters are often used. They may tend to promote absorption, but they increase suffering when there is consciousness, and the propriety of their use in the severe cases is questionable. The prospect of material benefit from any measure, notwithstanding the occasional favorable cases, is so remote that those which inflict much suffering should, as a rule, be avoided. Free doses of iodide of potas-

sium, even though producing catarrh and eruptions, I believe not only justifiable but demanded.

In all cases of acute, encephalic, meningeal, and cerebral inflammations, patients should be visited promptly and treated early. Minutes are of value. Though antiphlogistic remedies are generally called for in the early stages, yet it must be remembered that the disease is often very depressing in its effects, and general bleeding, active cathartics, and powerful arterial sedatives must be used with caution. While these measures are very useful in sthenic and plethoric cases, in the asthenic they are dangerous. Leeching and cupping are more safe than general bleeding, and, as a general rule, especially in suspected tuberculous cases, where the loss of blood is thought advisable, moderate and repeated abstractions, the effects being carefully watched, are preferable to a free venesection.

Patience will be required in lingering cases. A plan should be formed and pursued without too much regard to immediate conditions. Too large doses must not be given because results are delayed. Disturbing the patients must be avoided; they must be protected from officious nurses; in their delirium they must be persuaded rather than forced to compliance; must be sustained and soothed in proper cases, and sustaining measures must not be delayed until exhaustion is too far advanced. They are sometimes required even early, and often in the later stages of the disease.

CEREBRAL APOPLEXY.—CEREBRAL HÆMORRHAGE.— SUDDEN CEREBRAL EFFUSION.—SUDDEN EXTREME CON- GESTION.

The disease now to be considered, and which is covered by the foregoing terms, may be viewed in reference to its symptomatic and clinical phenomena, or its pathological character.

Clinically it is a sudden striking down—a more or less abrupt occurrence of inactivity of certain functions—a more or less complete cessation of sensation, voluntary motion, and consciousness, from some lesion of, and commonly *pressure* upon, the brain. In full and complete apoplexy the conscious, animal functions are entirely suspended, but the vegetative functions—respiration, circulation, calorification, etc.—usually go on in a more or less perfect degree for a time. The term apoplexy is not applied where these effects arise from external violence, as from a blow, producing fracture of the skull or concussion of the brain, whatever symptomatic or pathological consequences may immediately follow. The essential cause must

come from within. Pressure upon the brain is a common, and has been considered the essential, cause of the apoplexy; but the occurrence of an embolus suddenly cutting off the circulation from certain portions of the brain, may produce symptomatic conditions to which some apply the name of apoplexy.

In a more restricted and pathological sense apoplexy signifies a sudden pressure upon the brain, or injury of its substance, arising from causes within, and producing the striking down mentioned.

In a very large majority of cases the injury or pressure is from the effusion of blood; though the pressure of blood within the vessels, and the sudden effusion of serum into the ventricles, between the membranes, or into the brain substance, may produce the symptomatic results.

Writers have therefore recognized three varieties of apoplexy, viz.: *Apoplexia Sanguinea*, *Apoplexia Serosa*, and *Apoplexia Nervosa*, or more properly, as distinguishing the latter, *Congestive Apoplexy*.

The sanguineous variety is so much the more frequent that when the disease is spoken of without qualification, cerebral hemorrhage is commonly understood. During an attack we may not be able to say which of these varieties we have to deal with, and hence the clinical may precede the anatomical description.

Symptoms.—In a typical case, a man past middle life, of full habit, who has previously had symptoms indicating cerebral congestion or irritation, such as headache, a sense of constriction in the head, dizziness, ringing in the ears, weakness of memory, flushing, or sometimes temporary paleness, irritability of general feelings, neuralgic pains, heaviness in the limbs, hesitancy in speech, and sometimes irregularity of the heart's action, suddenly falls down in an unconscious state. His breathing is slow, labored, and stertorous, reflex excitability is lost or much impaired, the face is cyanosed from venous congestion, the pulse may be somewhat full and slow, though at first it is often small and frequent, and notwithstanding so much interruption of functions deglutition is still possible. The temperature is at first reduced, but at length it is elevated, and on careful examination one side of the body will generally be found more affected than the other, the face is drawn to one side, one hand if lifted up will fall more heavily than the other, and this condition, without material change, continues for some hours.

If the case be a moderate one, in the course of a few hours consciousness is gradually restored; but hemiplegia, more or less perfect, and difficulty of speech usually persist. The mental faculties, after the restoration of consciousness, remain confused, the patient appears lost as he looks around him, his tongue, if he protrudes it, deviates to one

side. In time the mind may clear up, the speech improve, his motions may be gradually restored, though seldom completely, his mental powers are seldom quite the same, and he may remain in this condition for years, though another attack is likely to occur, and generally of a severer grade.

In a severer form, instead of some improvement after a few hours, the coma becomes more profound, the pulse and respiration become more slow, there is more complete relaxation of all the limbs, the sphincters are paralyzed, the pupils become fixed, and danger of suspension of the essential functions of life is great.

If these symptoms continue or increase, and there is complete inability to swallow, the respiratory and circulatory centres will soon be invaded and death will occur. On examination of the brain in such a typical and fatal case, it will usually be found in some part torn by a rupture of a vessel, the effusion of blood, and the formation of a clot which has pressed upon the brain and at length overcome all its functions. In many cases with typical symptoms, the hemorrhage is capillary and the effusion is into the brain tissue.

But all cases of apoplexy are not thus typical. The symptoms may be without premonition, or they may come on more slowly and be less perfectly developed, and after improvement takes place from the brain becoming accustomed to the pressure, symptoms of inflammation may supervene, and death result from that cause.

In other cases there may be some headache, followed by paralysis, loss of speech, etc., with incomplete coma.

This disease may occur in thin, pale, anæmic persons. There may be pallor, sickness, and vomiting at the time of the attack, with a feeling of faintness; a feeble, flickering pulse; decided coldness of the extremities, and slight convulsions. The patient may not become entirely unconscious at first, but there may be confusion, loss of memory, failure of speech, and a gradual sinking into coma.

In other cases death may be almost instantaneous, the hemorrhage being at the base of the brain and immediately involving functions essential to life. In some cases hemiplegia precedes, continuing for hours, or even days, when coma supervenes and death follows; or from this state of hemiplegia, followed by comatose symptoms, recovery may take place.

In a majority of fatal cases life continues for three or four days, and more rarely for eight or ten; while sudden death is still more rare. In a majority of cases, however, of instant death, the disease is in the heart. In apoplexy, snoring respiration from a pendulous velum and a flabby puffing of the cheeks are common. There is a vacant, expressionless countenance, and usually some muscles are

more completely relaxed than others. The pupils vary, but in the profoundest condition of coma they are oftenest dilated.

Not only the phenomena of the immediate attack, but those that follow vary. The *inflammation* around the hemorrhage will vary in intensity, extent, and results, and may or may not interfere with recovery. It is marked by elevation of temperature, flushing or congestion of the face, pain in the head is complained of if consciousness has been restored, delirium is common, contraetures of the paralyzed limbs are likely to take place, and the pulse may become either more slow or more rapid. If the case is not fatal, the inflammation usually subsides in the course of a week, but it may remain longer. Collateral œdema of the brain may supervene in the course of the inflammation, and the patient may suddenly die from coma.

When the acute stage of cerebral hemorrhage, including the inflammatory reaction, is past, the more chronic consequences are presented. These may be grave. They consist of different forms of paralysis, generally of hemiplegia more or less complete. The ocular muscles, the tongue, and the limbs are affected in different degrees; disturbances of sensation also take place, and some parts are more affected than others; and many of the varieties of symptoms which occur in paralysis from other causes may be observed.

In most cases paralysis of sensation disappears more rapidly than that of motion, and the restoration of sensibility may be complete, but oftener some abnormality remains. Hyperæsthesia often follows for a time the anæsthesia, and sensibility is sooner restored to the deeper and more central parts than to those more superficial or distant. Electrical sensibility usually returns before tactile, or the sensibility to temperature.

The tendon reflex is generally easily excited in the paralyzed leg, and often more forcibly than that of the unaffected side. Sympathetic movements often appear in the paralyzed limb from mental excitement, in yawning, sneezing, etc., and from vigorous movements of the healthy side. The *organs of sense* are at first affected in apoplexy, but in favorable cases they usually soon recover.

Disorders of intelligence generally precede or follow cerebral hemorrhage, and it is worthy of note that such disorders appear to depend less upon the situation than the amount of extravasation. This would seem to indicate that the hemispheres act more as a whole in the production of mental phenomena, than that particular parts have special and *exclusive* mental functions.

Acute bed-sores are apt to be developed on the paralyzed side in a very few days, and they should be carefully guarded against. A central blister may quickly form, and when the cuticle is ruptured the

bare derma rapidly excoriates, and at the end of a few days a dry, brown crust forms; and this symptom is of serious import. Death often occurs before the eschar separates.

Diseases of the joints are sometimes observed to follow apoplexy. The affected joint becomes swollen, hot, moist, and painful, especially during motion.

Efforts have been made to trace the particular effects of hemorrhagic lesions as they occur in different parts of the brain, but the special symptoms depending upon the seat of the hemorrhage have not been sufficiently uniform to establish, in all cases, positive conclusions. It is alleged that psychical troubles play the chief part in hemorrhages into the cortical substance, and yet lesions, sometimes of an extensive character, occur in these parts without perceptible effects upon the mind. Hemorrhage into the anterior lobe, if of considerable depth, is said to produce aphasia and hemiplegia, with incomplete facial paralysis; and it would be easy to multiply statements from various authorities respecting the particular effects which follow lesions of nearly all parts of the encephalon. The subject, however, is more interesting in a physiological than a therapeutical point of view, and in a practical work these details may be omitted, at least until more uniformity of opinion is arrived at. A difficulty in arriving at positive conclusions, already referred to, is that through sympathy and the dependence of one part upon another, and the vicarious offices which different parts so frequently perform, uniformity of results does not take place. The functions of some parts of the brain are nearly or quite exclusive, and are satisfactorily ascertained, while others appear not to be fully differentiated, and seem to perform functions in connection with other parts, and to have their functions greatly modified by such connections.

As we come to the base of the brain the functions of different parts are better established, and a greater degree of uniformity of effects from special lesions therein is observed. Some statements as to localizations may be made with a degree of confidence.

Hemorrhage into the *motor ganglia* usually produces disorders of intelligence and of the special senses, of short duration, while hemiplegia is more constant. Hemorrhage into the *cerebral peduncle* is said not to affect intelligence or the special senses, but hemiplegia occurs with considerable diminution of cutaneous sensibility.

When a hemorrhage is so located as to involve or press upon any particular nerve, the part supplied by that nerve will, of course, be affected. When a large part of the *pons Varolii* is suddenly destroyed death usually occurs quickly. When the lesion is more limited, various consequences are mentioned as occurring, but it is to be added

that "in some cases all the characteristic signs are absent." (Rosen-thal.)

Paraplegia from cerebral apoplexy sometimes occurs. There are, then, two distinct but imperfect hemiplegias, and this condition is distinguished from spinal paraplegia by the presence of motor paralysis of the cranial nerves as well. The hemorrhages in such cases are thought to be symmetrical, though one may be old and the other recent.

Meningeal hemorrhage is thought by Virchow to be usually the result of inflammation of the internal surface of the dura mater, and the recently formed false membrane gives origin to the bleeding. These hemorrhages are sometimes profuse, and the blood may extend far between the membranes and into the ventricles, compressing a variety of parts and producing various results.

Pathological Anatomy.—Cerebral hemorrhage, as already stated, may be capillary, appearing in small points near each other, and may be found in the gray substance of the convolutions or in the deeper parts. The surrounding portions are softened and tinged with blood, the nerve fibres are separated, and the capillaries are softened, friable, and infiltrated with granular and fatty matter. Coagula occur in the small vessels, causing hemorrhagic infarction and softening, or capillary dilatation. In other cases rupture of arteries occurs, and rounded cavities, or more elongated ones, following the directions of the fibres, are produced. The form and dimensions of these foci vary exceedingly. They may be limited to a small part of the brain, or may extend so as to occupy a whole hemisphere, breaking through its substance in different directions. The blood may be effused into the ventricles, or accumulated between the membranes. From a drachm to many ounces may thus be effused. From a large number of autopsies made in the Vienna Hospital the hemorrhage was found to have taken place most frequently in the corpus striatum, and next in the optic thalamus, and in the nucleus lentiformis. In some cases it involved more than one anatomical division of the brain, and the fact was shown that the lesion may occur in any part of the organ.

In favorable cases, where recovery takes place, a false membrane surrounds the effused blood, a serous secretion dissolves the clot and the debris of the brain tissue—the mass assumes a yellowish or brownish color; pigmented bands of connective tissue traverse the cavities, which are known as apoplectic cysts. These cysts are formed in from two to three months after the hemorrhage; and in favorable cases their yellowish fluid contents are absorbed, the connective tissue retracts, the walls approach and coalesce, many small vessels become obliterated, and a stellated apoplectic cicatrix results.

Various secondary functional lesions follow, depending upon the extent and position of the primary organic changes. These functional changes are motor, sensory, and nutritional.

Etiology.—Rupture of the cerebral vessels, oftener the arterioles, is the immediate cause of hemorrhagic apoplexy.

This rupture arises from degeneration or weakness of the vascular walls, or from an abnormal increase of arterial pressure, or from both combined. At any rate, there is loss of proportion between the blood pressure and the resistance of the walls of the vessels, and a blood flow is the consequence. This weakening of the vessels may be due to the debilitating effects of certain diseases, or the degeneration of the cerebral tissue, so that the vessels are not properly supported; or they are involved in the degenerative process.

The most frequent cause is a primary degeneration of the vascular walls. Formerly cerebral hemorrhage was regarded as more frequently due to atheroma of the larger cerebral arteries; and the friability of their walls, generally the result of age, was supposed to be produced by fatty or calcareous degeneration, especially of the internal coat. It is now known that a frequent cause of the hemorrhage is fatty degeneration of *small* cerebral arteries, particularly of their middle and inner coats, and that often the outer or adventitious coat is dilated rather than ruptured, the blood passing between this and the other coats, and producing numerous minute, flask-shaped aneurismal enlargements instead of true hemorrhage. When these points are few in number and scattered, but slight effects may for a long time be produced; but when numerous and aggregated together, apoplectic symptoms result. The adventitious coat of the arterioles, however, is often ruptured with the others, and a true hemorrhage follows. Preceding these changes, thickening, sclerosis, and sometimes fatty degeneration, such as has long been recognized in the larger arteries, take place. These changes most frequently occur after fifty years of age, though they are occasionally seen at an earlier period. When they exist an increase of vascular pressure is liable to produce rupture of some or all of the coats, and the phenomena which have been described.

This increase of vascular pressure or tension may arise from lesions of the brain itself, or from causes outside of that organ.

The arrest of circulation due to vascular spasm, as in epilepsy or eclampsia; congestion from thrombosis; dilatation of capillaries from pigment emboli; accumulation of white blood corpuscles in pyæmia; toxic irritants of the brain, etc., generally cause increased pressure in certain parts. The causes which operate outside of the brain, inducing congestion or increased blood pressure, have already been

noticed (see article on Cerebral Congestion) and need not be repeated in detail.

A bad diet, overeating, alcoholics, overexertion (mental or physical), straining at stool, lifting, constipation, vomiting, excesses of every kind, and forced expiratory movements are among the more common causes of rupture when the vessels of the brain are weakened. Hypertrophy of the heart, obstructed circulation through other organs, etc., must not be overlooked. Heredity is often a predisposing cause; and age, as already intimated, exerts much influence.

The liability is markedly increased with age.

The foregoing pathological account refers to apoplexy from cerebral hemorrhage, which, as stated, is by far the most common form of the disease.

Serous Apoplexy, or sudden effusions of serum in the substance or cavities of the brain, is possible; but in these cases a general dropsical state, or an inflammation of the membranes, or some other recognizable morbid condition is usually present. The case will then be complicated, and the apoplexy is a secondary symptom.

Congestive Apoplexy is rare. There is seldom sufficient compression of the brain from blood within its unruptured vessels to cause the full and sudden apoplectic condition. It is, however, possible, and death may be produced by extreme hyperæmia. But the symptoms very commonly stop short of producing complete unconsciousness, at least for any length of time; and complete recovery without paralysis is the usual termination. The term apoplexy is by many denied to these forms of disease.

Diagnosis.—The case of a patient found in a state of unconsciousness without a clinical history is not always easily diagnosticated. If he be advanced in years, if there be rigidity of the arteries, if one side is more flaccid than the other, and if there be no evidence of external injury or of intoxication, there will be a presumption of apoplexy. If it be known that the attack was sudden and in the midst of activity and excitement, the diagnosis will be strengthened. *Simple cerebral hyperæmia* may present similar symptoms, but they usually soon subside. *Syncope* will present great pallor, an imperceptible pulse, and for a short time suspended respiration; but all will soon be over. In *epilepsy* the patient will be, or will have been, in convulsions, the seizure having usually been accompanied with a cry. In meningitis, if coma occurs, there will have been preceding symptoms—a chill, severe pain, etc.—and a more gradual approach of the symptoms, which some one has witnessed. In *uræmic poisoning*, convulsions may have preceded the coma, the attack was less sudden, dropsical

conditions are likely to be present, and on testing the urine albumen and casts will usually be found.

In *opium poisoning* the pupils are contracted, the breathing is slower, and the patient by strong efforts can usually be momentarily aroused so as to manifest some consciousness. In *alcoholic poisoning* there will be the odor of alcohol, absence of hemiplegia, the pulse is commonly feeble and frequent, and the pupils are usually dilated. In neither opium nor alcoholic poisoning does hemiplegia occur.

Apoplexy (cerebral hemorrhage) may come on in conditions of intoxication, whether from urea, opium, or alcohol, when the diagnosis will be more difficult. If hemiplegia occurs, apoplexy may be inferred.

When the history is not known, a careful examination of the head for evidences of external injury should be made.

In *cerebral tumors*, intermitting headache and other symptoms have preceded; and in *hysteria* the undisturbed pulse, the placid face, the irregular respiration, and the occasional cries will be sufficient to reveal its character. Hysteria, however, sometimes strongly resembles apoplexy, as it so often does other affections, and when hemiplegia occurs in hysteria, as is sometimes the case, time may be required to determine the diagnosis. In apoplectic hemiplegia the median line bounds the loss of motion and sensation, but in hysterical cases abnormalities commonly exist in the other side as well. The face is generally calm in hysteria; but the case will not long continue without the appearance of other and characteristic symptoms of hysteria.

In *spinal hemiplegia* the face escapes any change, and sensibility is not usually lost in the side deprived of the power of motion. Upon the opposite side sensation may be lost, but motion and electro-muscular contractility are intact.

Apoplexy from cerebral hemorrhage is to be distinguished from *embolism* and occlusion of vessels beyond the circle of Willis, by the following, viz.: The latter occurs without reference to age; there are no cerebral prodroma; the paralysis is more likely to be on the right side; and in a great majority of cases it is associated with disease of the heart. The detachment of clots from the diseased valves was referred to when diseases of the heart were described. If partial or complete hemiplegia comes on in a person under forty, with organic disease of the left side of the heart, either with or without previous attacks of rheumatism, and especially if the paralysis affects the right side of the body, and instead of disappearing after the first three or four days persists without improvement, the case may be presumably pronounced one of embolism.

In *thrombosis* of the vessels of the brain, the symptoms come on

more slowly, preceded by evidences of disease of the vessels; but the final attack may resemble apoplexy, and the diagnosis must often be conjectural.

Some cases of *pernicious malarial fever* present symptoms distinguishable with difficulty from those of apoplexy. But malarial fever is not specially prevalent with the aged; there is a history of malarial exposure, and usually previous attacks of ague; malarial prodroma have preceded, and generally there have been preceding paroxysms of fever, during which a tendency to the occurrence of stupor has appeared; and usually the coma is not as profound as in cerebral hemorrhage, and hemiplegia is absent.

Prognosis.—The prognosis of cerebral hemorrhage with apoplectic symptoms has already been referred to.

It will vary with the extent and site of the hemorrhage, the amount of blood pressure, and the amount of disease of the arteries. These cannot always be ascertained. A lowering of the temperature for several hours after the attack, followed by a marked elevation, is an unfavorable sign; and the early appearance of bed-sores indicates a lowered vitality which threatens a fatal termination.

The danger is usually measured by the profoundness and persistence of the coma, and by the evidences of the invasion of the functions of the lungs and heart. The severity of the succeeding inflammation may determine a fatal result. An extreme elevation of temperature is always dangerous. The degenerative changes of the arteries which lead to their rupture is seldom confined to a single locality, and hence subsequent hemorrhages are exceedingly liable to occur. In making a prognosis, the danger of a relapse must always be considered. The prognosis as to recovery from the paralysis which persists after the attack is not very favorable. In slight cases the paralysis may soon disappear, but usually some impairment is permanent, and often it is great. When muscular atrophy is progressing, and many contractions occur, restoration is not to be expected.

TREATMENT OF APOPLEXY.

This may be divided into *prevention*, treatment of the *attack*, and treatment of the *resulting symptoms*.

In a disease so serious in its attack and consequences, prophylaxis is of great importance. In a person thought to be predisposed to apoplexy from heredity, conformation, habits, rigidity of arteries, etc., all premonitory symptoms should be carefully noticed. A moderate and strictly temperate life in all respects should be insisted upon.

Excesses in food or drink, or in exercise or excitement should be

carefully avoided. A plain and simple, but not starving, diet should be advised. Constipation, if it exist, must be remedied. There must be no straining at stool or lifting of heavy weights. The last meal of the day should be early and light. Alcoholics should be avoided, and intense mental and physical exertion combined, as in a protracted oratorical effort, is dangerous.

When an attack is immediately threatened by flushing of the face, severe sense of fullness in the head, a hard tense pulse, thickness and difficulty of speech, giddiness, staggering, etc., blood should be immediately drawn from a vein, if the patient is at all of a full habit, or in a previously vigorous state.

Of the propriety of this measure, under these circumstances, there can be no doubt. As a substitute for this, or where the patient is more feeble and has less blood, the body should be placed in an easy reclining position, with the head well raised, and all the restraints to the return of circulation from it should be removed. Cold should be freely and constantly applied to the head; dry cups might be freely applied to various parts of the body, and, as a very efficient temporary means, when properly managed, the extremities should be ligated. The object is to retard the return circulation through the veins, care being taken not to apply the ligature with sufficient tightness to arrest the circulation through the arteries. A large quantity of blood can thus be retained in the limbs, and the pressure upon the brain diminished. These means, and especially the venesection, may prevent a hemorrhage that would otherwise take place. A revulsive effect upon the bowels by means of a brisk cathartic will usually be called for, and, though less prompt, it will be more permanent in its effect than some of the other measures spoken of. Bromide of potassium, when there are symptoms of irritation, perhaps ergot, and sometimes arterial sedatives, such as *veratrum viride* or *aconite*, may be required when the heart's action is excited. These agents should be given in sufficient doses to diminish promptly the force of the heart's action.

The treatment of the *developed disease* is attended with more embarrassment. When an attack actually occurs, and the hemorrhage has already taken place, remedies are less effectual; but the hemorrhage is likely to go on, and the pressure of the blood upon the brain and the rupture of other vessels and of its substance are likely to increase and extend, and *similar means*, when they can be borne, should be resorted to for their arrest. The pressing indication here, as in other extreme cases, is to "obviate the tendency to death." For this purpose it is important to consider the manner in which the life of the patient is immediately threatened. If the danger is from

the continuance of the hemorrhage, and the increase of the pressure upon the brain, and there is *high arterial pressure, the bleeding, the cold applications, the elevation of the head, the ligation of the extremities, the revulsive cathartics, the bromide, and the arterial sedatives are called for*. A drop or two of croton-oil, or half a grain of elaterium may be given, or placed upon the tongue if the patient cannot swallow; and the tincture of veratrum viride, in doses of six or eight drops, repeated usually in somewhat smaller doses, but so as to obtain its effect upon the heart; or the tincture of aconite, in doses of from three to six drops, may be cautiously prescribed.

When the patient is plethoric, and not too old; when there is evidence of congestion—when the face is flushed, the carotids beat with force, and the pulse at the wrist is hard—then the old and classical routine of bleeding, cold to the head, warmth to the extremities, revulsives and sedatives, should be used discriminately but decidedly. As in other cases of internal hemorrhage, ergotine might be administered hypodermically.

But the greatest danger is not always from pressure, and a firm pulse, flushed face, and full habit are not always present.

Atheromatous or degenerated vessels may give way without extraordinary pressure, and the life of the patient may be threatened by the shock of the brain rupture, or the depression of some function produced by the solution of continuity, the result of a hemorrhage in a particular part. The heart's action may be feeble, the face pale, and all the vital activities may be depressed. Taking blood freely in such a case might be disastrous, by depressing still farther the powers of life. A broken-down gouty patient, with the arthritic cachexia, perhaps laboring under Bright's disease, with the blood contaminated, some vessels rough, contracted, forceless, and obstructed, and with a part of the brain but imperfectly supplied with blood; such a patient falling down pale and faint, the heart feebly struggling, and life flickering from depression, will require an opposite course of treatment. Stimulants—agents to diminish shock and excite the heart—may be demanded. Spirits of ammonia, camphor, ether, alcohol, warm drinks, etc., will be indicated. These measures will then be appropriate with the view of obviating the immediate tendency to death.

In other cases which present neither of the extreme features described, where the heart's action is moderate, the pulse soft but not flickering, the face not pale or particularly flushed, the blood pressure moderate but not dangerously deficient, *expectant* treatment only may be required. The head should be raised, cold may be applied to the head and warmth to the feet, the apartment should be well ventilated, of an even temperature, and entirely quiet, the bowels should be

moved by a moderate cathartic aided by an enema; if the stomach should be overloaded, vomiting might be encouraged by the finger in the throat, or possibly by a stimulating emetic, and if the hemorrhage is supposed to be continuing, ergot might be given by hypodermic injection.

The question of treatment, especially as to bleeding, will depend upon the particular condition of each case. Bleeding would diminish pressure and blood tension, and would tend to arrest internal hemorrhage, but it would not relieve shock, and might prevent a necessary reaction. If a clot has already formed, the lateral pressure and the involvement of vessels may arrest circulation in portions of the brain, while blood pressure is increased in other parts.

In such a case the effect of bleeding would be doubtful. It might or might not increase the chances of life. The best guide is then the condition of the pulse; if hard and firm, bleeding might be useful. Local bleeding, perhaps, and certainly revulsive measures, should be substituted when there is doubt. It will be impossible to say in a given case whether larger or smaller arteries are ruptured, or whether partial rupture and aneurismal dilatation of minute vessels constitute the pathological state; nor is it essential in reference to treatment. The pressure that dilates vessels will call for the same measures as that which ruptures them.

In the different cases, then, bleeding, stimulants, or expectancy may be the proper remedies.

In blood pressure within the brain, whether it is out of the vessels or within them, the circulation in the capillaries is likely to be interrupted, and the interference with functions is largely from blood stagnant in the ultimate vessels, and a consequent deficient nutrition of the power-producing cells.

Pressure upon the conducting elements in the brain tissue may also interrupt function. The diminution of pressure will favor capillary circulation, but there must be a certain amount of heart force to effect that circulation under the embarrassment of the pressure, which may not be entirely removable. The effects of blood-letting and other depressing agents are not simple, but twofold, and the ultimate results are not uniform or always calculable. This, however, is the case with various remedies and in different diseases.

Therapeutics is not an exact science. There are unknown elements in many cases; but with a knowledge of the principles concerned, the probabilities must be estimated and the judgment of the physician must be exercised, and certain risks must be taken. There is responsibility for what is omitted as well as for what is done. But, on the whole, caution and conservatism are better than rashness, and

of the two extremes there may be less objection to doing too little than too much.

Where art is too uncertain, nature should be given an opportunity to accomplish what she can. In giving directions for treatment where indications are not positive, principles are to be stated, and their application to particular cases must be left to the judgment of the practitioner.

Should the comatose condition linger after depleting measures have been used, or where they are not judged advisable, bromide of potassium or bromide of sodium should be given; the bowels should be kept open, the bladder should receive attention—should often be evacuated by the catheter; the surface on which the patient rests should be smooth, dry, and soft, so as to prevent bed-sores, and a light, liquid diet should be given.

Should symptoms of irritation and inflammation follow, they must be met according to the indications presented. The treatment will not materially differ from the treatment of cerebritis from other causes, but presenting similar symptoms. In some cases venesection may be called for, but oftener leeches to the mastoid process, cathartics as may be borne, bromides, cold to the head, etc., will be required.

Absorption of exudates may be promoted by iodide of potassium, diuretics, possibly mercury, and proper revulsives. The paralysis remaining will require proper attention. As the lesion producing it is in the brain, the attention should be chiefly directed to that organ. The repair of the central injury must take place before its effects are removed.

Nature must do the work, and it is doubtful whether art can render much assistance. If at any time inflammatory processes are evinced by symptoms of irritation, they should be treated according to their indications.

Bromides, ergot, belladonna, iodide of potassium, moderate revulsives, etc., may be required. Gentle frictions may be applied to the paralyzed muscles, but electricity and strychnine should not be used until symptoms of irritation have subsided, and until all danger of reproducing them by these exciting means is past. Rosenthal says that electrical treatment of the paralysis may be begun, in the slight forms, at the end of two months. In more severe cases, electricity must not be employed until all the symptoms of irritation have disappeared—perhaps in from four to six months after the apoplexy. The continuous current, which produces irritant effects upon the nervous centres and organs of special sense, should only be applied with great caution to the head and neighboring parts. The faradic current is preferably employed in paralysis of the extensors with

predominance in the activity of the flexors. In long standing disorders of sensation we may use the electric brush. Faradization may give good results in slight muscular atrophy, and in contractions of the flexors. In the treatment with galvanism, descending currents should be employed from the dorsal spine to the nerves of the paralyzed or contracted muscles. The current should produce moderate muscular responses, and its intensity may then be gradually increased. Three or four sances, lasting from five to eight minutes, are to be given every week.

The combination of hydrotherapeutic measures with electricity has been found to cause improvement in some severe cases, but most cases of severity resist all forms of treatment. In this lesion of the brain complete reparation is usually impossible.

The condition of chronic weakness, so often following apoplexy, renders a quiet life, proper regimen, and light but nourishing food necessary. All the functions, as far as possible, must be regulated. Bathing, beyond mere ablutions for cleanliness, must be used with caution, if at all, and so as to secure proper but not great reaction, and not till after the irritative symptoms have disappeared. There is danger that fresh hemorrhages may be induced by the excitement of warm baths, in those who have diseases of the heart and rigid arteries. The same is true of all excitements, physical and mental. The extremes of temperature, whether by baths or other exposures, should be avoided.

With the facts and principles concerned in apoplexy, the student should be particular to make himself familiar. As he enters upon practice he is liable at any time to have thrust upon him the responsibility of an important case requiring *careful deliberation but prompt action*.

Heroic routinism or hesitating inefficiency may alike be destructive to his reputation, or, what is more, to the life of the patient. Clear conceptions and definite opinions are essential to that calmness of mind which will admit, under the excitement of the moment, of the exercise of a sound judgment and the putting forth of judicious action.

CEREBRAL EMBOLISM AND THROMBOSIS.

Cerebral embolism consists in the plugging up of an artery of the brain by a floating clot of blood, usually detached from the endocardium or valves of the heart.

By this the circulation of the blood is interrupted in a portion of the brain, and its function is of course suspended when the cir-

ulation is entirely cut off. An increase in the circulation of collateral vessels may supply the deficiency by the anastomoses which exist, and the function of the part may then soon be restored. On the other hand, the anæmia may persist; the collateral pressure may cause irritation or capillary hemorrhage, inflammation and exudations or sclerosis may follow, the part deprived of blood may undergo *softening* and *necrosis*, and the function of the part may be permanently destroyed. In other cases a feeble circulation in the anæmic part may be continued, and fatty and other degenerative changes may take place, softening may follow, or inflammation may be excited, and abscesses may ultimately result.

Cerebral Thrombosis is the formation of clots in the vessels of the brain at the point where they are found, and generally from some morbid condition of the vessels. These thrombi, like the emboli when the lumen of the vessel is closed, lead to similar consequences in the part deprived of blood.

Etiology.—The causes of these *embolic* formations, besides diseases of the endocardium and cardiac valves, are fatty granules from suppurative deposits, obstruction of minute arteries by accumulations of white blood globules in pyæmia and in leukæmia, and rarely by the accumulation of pigmentary substances in malarial fevers. The introduction of various foreign substances into the blood-vessels—gangrenous, puriform, syphilitic, or other morbid matters—may produce the result.

Thrombi may be formed by inflammation, atrophy, fatty degeneration, and other diseases of the vessels; such as are produced in pyæmia, puerperal diseases, scurvy, chronic alcoholism, and syphilis. Thrombi often break up and the fragments move on, causing obstruction in more terminal vessels. These changes may be excited by accidental causes, such as straining, changing of posture, coughing, etc., or by mental excitement.

Some vessels more frequently than others are the seat of obstructing clots. The left carotid is more liable to this obstruction than the right. Among the arteries of the brain the middle cerebral is most frequently affected.

Hemorrhagic infarction is a frequent result of embolic obstruction here as in the lungs.

The principal or larger vessels of the brain send distinct branches to different parts without anastomoses, but the cortex is supplied with minute anastomosing branches. The results of embolism are not as serious, therefore, in the cortical as in the medullary substance of the brain.

Men are more subject to emboli than women, and adults from

twenty to forty than younger persons or those more advanced in life.

Symptoms.—The symptoms will vary with the location and extent of the lesion caused by the embolus. Those resulting from this accident usually begin suddenly.

The patient commonly falls down, and frequently has convulsions. The face is usually pale and cold, consciousness is lost, but returns in a short time or in a few hours, and as it returns disorders of motion, of sensation, of the special senses, and of speech, are apt to be manifested. Hemiplegia is common, though generally incomplete, and is oftenest on the side opposite to the lesion.

The muscles of the face and of respiration are apt to be more or less involved. Hemipopia and unilateral amaurosis, with alternate hemiplegia, would be characteristic of embolism of the central artery of the retina and extravasation into the optic nerve, and of a cerebral embolus as well. The ophthalmoscope then shows pallor of the papillæ and absence of pulsation in the retinal arteries, and small hemorrhagic spots are observed. The embolic amaurosis may precede the cerebral embolism.

Aphasia is another common symptom of cerebral embolism. There is usually the preservation of intelligence and of the movements of the tongue, but the power of recalling words is greatly impaired or lost. This loss of speech is produced by various lesions, and is of different degrees of completeness. It sometimes occurs in typhoid fever, the acute exanthemata, Bright's disease, diabetes, catalepsy, epilepsy, and hysteria. It is temporary or intermittent in many of these affections, but is more permanent in cerebral embolism, hemorrhage, and softening.

Within the past few years many autopsies have shown lesions of the left frontal lobe and of the posterior part of the third frontal convolutions in these cases of aphasia. The island of Reil and its neighborhood more particularly have been observed to be the seat of lesions in aphasia. It is found that these parts of the brain are supplied with blood by the middle cerebral artery, but some of the branches of this artery supply other parts, the central convolutions, the parietal gyri, and the adjacent temporal convolutions. When all the branches of the central artery have their circulation arrested, hemiplegia of motion and sensation, with marked aphasia, will be very likely to result. When the arrest of circulation is not so extensive, aphasia without the hemiplegia may occur. The united anatomical and clinical facts have seemed to show that in man the function of language has its central seat, though probably not its exclusive location, in the region above indicated, and it is at present the received opinion among many

that this is the case. Some observations, however, have thrown doubt upon even this view of localization. In left-handed people it is alleged that lesions upon the right side cause aphasia, but the exclusive location of the complex faculty of speech in any part of the brain cannot be regarded as fully demonstrated. Some observers of high authority deny it. It must, however, be acknowledged that in cases of aphasia, accompanied with other evidences of embolism, the presumption is that the left middle cerebral artery is the seat of the embolus.

But different arteries may be obstructed with emboli at the same time. Both sides of the brain may be affected, but generally from different attacks; and arteries in the different organs of the body may be affected so as to produce complications. A variety of symptoms will then be produced.

Course and Termination.—Cerebral embolism may terminate by the breaking up of the clot and its absorption before softening and other serious lesions appear in the part affected. This is more likely to be the case when the obstruction is on the proximal than when on the distal side of the circle of Willis. Past that point the collateral circulation is not as readily established, and permanent lesions and loss of functions are more likely to take place. In the most favorable cases, beyond the circle of Willis, cysts or cicatrices form which leave more or less impairment of brain structure, and very generally decided impairment of function.

Diagnosis.—It is sometimes very difficult or impossible to distinguish with certainty embolism from hemorrhage; but the circumstances which aid in the differential diagnosis have already been pointed out.

The character of the premonitory symptoms, the fact of heart disease, the sudden unilateral amaurosis, with hemiplegia of the opposite side, the appearance of aphasia with right hemiplegia, would indicate embolism rather than hemorrhage. If an apoplectiform attack occurs in a young adult who has previously had endocarditis, embolism may be regarded as the condition.

Prognosis.—The prognosis of cerebral embolism is grave. Some cases recover in the manner described, but the lesions are oftener permanent, and in cases of recovery there is usually danger of subsequent attacks.

Treatment.—The treatment, from the obvious nature of the disease, cannot be specific, or, so far as the removal of the embolus is concerned, of much effect. At the time of the attack bleeding is not indicated, and stimulants will seldom be required. Quiet and complete rest are important. As reaction takes place cold should be applied to the head, the bowels should be opened; and if inflamma-

tory symptoms appear, the ordinary antiphlogistic measures should be adopted.

Bromides may be required to quiet cerebral irritation, and at a later period the iodide of potassium may aid in removing the consequences of the lesion. I have seen some cases of aphasia with other symptoms, apparently the result of embolism, steadily improve under the use of bromide and iodide of potassium combined. When tonics were tried, the symptoms were made worse.

Paralysis of the limbs should be treated on the same principles as described in cases of cerebral hemorrhage. By exercising the patient in recalling short and simple words, and in writing easy sentences, we may in favorable cases aid in restoring the faculty of language.

SCLEROSIS OF THE BRAIN AND SPINAL CORD.

Sclerosis of the brain and spinal cord are so frequently found occurring in the same case—the sclerosis is so often diffused through both of these organs—that though not strictly systematic it appears more convenient to include both of these together in this general discussion of the subject.

A hyperplasia of connective tissue of the brain, resulting in hardening of its substance, obliteration of proper brain elements, and impairment of function, has already been referred to when subacute and chronic cerebral inflammation was considered.

A sclerosis of the brain and spinal cord, sometimes confined to one, but oftener involving both these organs, sometimes occurs with less marked symptoms of inflammation, but with evidences of disease of a more chronic character, the principal symptoms being those of the impairment of brain or spinal functions, progressive and persistent, mostly of a paralytic nature. These morbid changes may be more or less extended in the involvement of parts.

Morbid Anatomy.—The anatomical changes have been carefully observed. This *Chronic Sclerosis* affects various parts of the nerve-centres. In the brain the medullary tissue is more frequently affected than the cortical substance. A large and continuous portion may be involved, when it is spoken of as *diffused cerebral sclerosis*; or it may be in different foyers or patches, when it is called *multiple* or *disseminated sclerosis*. In the brain the foyers are found to vary in size from a grain of hempseed or a pea, to a hazel nut or almond, and the spots are of various shades of color. Some are pale gray, semi-transparent, and hard; some are isolated, rounded, and sharply defined; others confluent, with serrated or otherwise irregular bor-

ders. Some have a reddish-gray color and a softer consistence. The cut surfaces present a bloodless, dull, milk-white appearance, though in the centre will often be found bluish or grayish-red points. In the white part of the brain some nerve elements may commonly be distinguished, but in the gray the nerve cells are obliterated. Most parts of the brain are subject to these changes, but some more than others; while in the spinal cord all parts are involved indifferently.

These patches sometimes involve the origin of the cerebral nerves, oftenest the optic, olfactory, and trigeminal; and they have been observed upon the roots of the spinal nerves.

The microscopical examinations by recent observers have shown that "a nuclear proliferation occurs in the peripheral zone of the sclerosed patches, within the trabeculae of the reticulum, which is at first very much thickened, then becomes more and more indistinct, and is finally replaced by connective-tissue fibres. We can also detect some small cellular elements, with atrophy and partial disappearance of the nerve fibres and preservation of the axis cylinders, which are sometimes very much hypertrophied.

"In the central portions of the patches, the reticulum is entirely replaced by new-formed fibres, containing many amyloid corpuscles. The trabeculae, cellular elements, and nerve fibres have disappeared, with the exception of a number of atrophied axis cylinders. There is considerable thickening of the walls of the vessels, with proliferation of the nuclei. The spinal cord is strewn with tracts of connective tissue, which contain, in addition to cellular elements, a considerable number of amyloid corpuscles. The nerve cells are in a condition of yellow degeneration (Charcot), and atrophy in the anterior horns (Schuele), posterior horns (personal observation), and in the nuclei of the nerves of the medulla (Jeffroy)." (Rosenthal.)

According to the observation of others, in addition to the proliferation of connective tissue, or the "neuroglia" element, and the presence of amyloid corpuscles, etc., *fatty* granules and granular corpuscles are found, especially in the thickened vascular walls. More or less pigmentation is also found in some cases, and mammary-form cells may sometimes be observed.

In the production of these anatomical changes it is now satisfactorily shown that the vascular system plays a most important part. The morbid process has many of the elements of inflammation, though of a slow and peculiar kind. The vessels are dilated and thickened not only in the patches of sclerosis, but also in the adjacent portions of the brain or cord, and those portions of the brain are most likely to be affected that have the freest and most direct vascular supply. A greater amount of change occurs in the immediate

neighborhood of vessels, and clinical observations show that sclerosis of the nervous centres is often apparently due to emotional disturbances and physical and intellectual efforts, to cold, etc.—conditions which particularly affect the vascular system. These circumstances indicate that the state of the nerves and the disturbance of the circulation are primary, and that the nuclear proliferation, the hyperplasia of the net-work of connective tissue, and the atrophy and degeneration of the nerve elements are secondary phenomena.

Symptoms.—The symptomatic phenomena will vary according to the locality of the lesion.

In the cephalic form the first symptoms are usually nausea, vertigo, cephalalgia, syncopal and apoplecticiform attacks, followed by various forms of disturbance of vision, of speech, and of intelligence.

When the spine is the seat of the lesions, the patient complains of various abnormal sensations, is often easily fatigued, has partial paresis, with an unsteady gait, sometimes there is inequality of the pupils, and other obscure but increasing symptoms.

In most cases there are lesions of both the brain and cord, and a mixed train of symptoms results. At first there are symptoms of irritation, but these scarcely attract attention, or they may be confounded with merely functional nervous derangements. There will be neuralgic pains in the head or limbs, slight convulsive movements, weakness or partial paralysis of one or more of the limbs. In rare cases more positive convulsions may occur, followed by hemiplegia. In a larger number of cases the lower extremities gradually lose their power, and at length their movements are hesitating, difficult, and tremulous. This *tremulousness* following incomplete paralysis of one or both of the lower limbs—the agitation occurring only when motion is excited by the will, or by communicated impulses, or by some form of excitement—is the most diagnostic symptom of this state. The muscles are quiet, or nearly so, when the patient is entirely at rest. On attempting motion the most grotesque automatic movements often occur. But the particular symptoms are exceedingly numerous, as the number of lesions are so various. Motor changes are much more frequent than sensory, but the latter occasionally take place. This will particularly be the case when the posterior columns are seriously involved. There is sometimes increased reflex excitability, and a ready response to mechanical or electrical excitation; but in most cases toward the latter stages electro-muscular contractility and galvanic excitability of the nerves diminish.

The visual tract or the optic nerve may be involved, when sight will be impaired. There may also be deafness in one or both ears, from involvement of the auditory nervous apparatus.

The *mind* may be much or but little affected. In the early stage there is usually exaltation, but later there is mental depression. There is usually weakness of memory and intelligence, childishness, irritability, and fits of unmeaning laughter and weeping, and at the last dementia, more or less complete, supervenes. Speech is generally difficult, slow, and often syllabic, and the voice becomes feeble and monotonous. All the symptoms increase as the disease advances. the movements become more and more weak and less coördinate, contractures occur, the sphincters lose their power, mastication and deglutition become difficult, feverish excitement often takes place, nutrition fails, and the patient dies from collapse, and often in an unconscious state.

Diagnosis.—In the early stage of the disease the diagnosis is obscure, and often for some time impossible. It may be confounded with paralysis agitans, cerebral softening, tumors of the brain or cord, and locomotor ataxia. The differential diagnosis requires care.

Paralysis agitans is characterized by *rhythmical* involuntary movements. It may be confined to one side. In walking, the patient inclines to the affected side; he bends forward, and often trots rather than walks. There are usually no serious disorders of articulation, no increase of reflex excitability or incoördination of movements.

Cerebral softening occurs mostly in advanced life; there is earlier and more sudden abolition of mental functions, oftener aphasia, hemiplegia, and contractures. In softening, apoplectic attacks are more common; and hemiplegia, anæsthesia, or paralysis of one or more of the extremities, and on the opposite sides of the body, are also more frequent. The course of softening, furthermore, is more rapid.

Cerebral tumors are accompanied by greater periodicity of symptoms—such as headache, vertigo, convulsions, fits of mental perversion, etc.—and are not accompanied by tremors in the limbs or special disorders of speech.

In *locomotor ataxia* there are no cerebral symptoms until very late in the disease; there are lancinating pains, generally an absence of the tendon-reflex, and there is want of coördination of movements rather than loss of muscular power.

In *cerebro-spinal sclerosis* the disease usually commences between twenty and forty years of age, seldom later in life; and it is slowly progressive, seldom producing death, except by some intercurrent disease, in less than four or five years; and its average duration is from six to ten or twelve years, and it may extend to twenty. It varies in progress; it may be stationary for long periods, or the symptoms may even improve, giving delusive hopes of recovery; but experience has proved that death is the ultimate termination of the disease when it is so fully established as to become clearly distinguishable.

Treatment.—Could the disease be distinguished at a sufficiently early period, there might be hope of arresting the inflammatory condition which results in the anatomical changes that have been described. When pain in the head, vertigo, nausea, syncope, and apoplectiform attacks occur, not traceable to reflex irritation from the stomach, from oxaluria or other causes without the brain, a course of treatment should be instituted with the view of arresting the slow inflammatory action which is likely to be present.

Rest should be enjoined, a regulated diet prescribed, revulsive cathartics may be required, and a course of *iodide* and *bromide of potassium*, with, for a time, the addition of ergot, is worthy of a persistent trial. This course is suggested on general principles and from analogies; and although I cannot say that by this treatment multiple sclerosis has been averted, yet by such treatment these symptoms have not unfrequently been relieved, and there is reason to believe that more serious affections, including sclerosis, may have been prevented.

When the disease is clearly recognizable, it is exceedingly doubtful whether any treatment is capable of producing material effects upon its course.

Chloride of iron, phosphide of zinc, nitrate of silver, strychnia, arsenic, galvanism, and hydrotherapies have been recommended, and have each been thought to produce temporary relief; and these, and perhaps other remedies, may be prescribed as may be judged proper by the physician. Nothing, however, which has yet been tried has obtained the confidence of the profession, and all medication which is other than simply symptomatic and palliative must be regarded as experimental.

When, however, obvious symptomatic indications are presented they should be fulfilled. When evidences of hyperæmia and irritation of the brain and spinal cord are present, bromide of potassium, ergot, and belladonna may be given. In some cases a course of iodide of potassium has seemed to check the progress of the degenerative process after its more complete establishment; and I should hope more from this than from most, or perhaps any, of the other remedies which have been advised. Proper hygienic management, and the improvement of the general health, will, of course, be required.

BULBAR SCLEROSIS; OR, LABIO-GLOSSO-PHARYNGEAL PARALYSIS.

By the researches of Chareot and Joffroy, of Dachenne, Huss, and others, attention has been directed to changes in the nuclei at the ori-

gin of the bulbar nerves situated in the fourth ventricle of the brain. Degenerative changes, similar to those already described, sometimes occur in this situation, involving the origin of the hypoglossal, pneumogastric and spinal accessory, and sometimes the glosso-pharyngeal, the facial, and external motor-oculi nerves. In rare cases the motor and sensory nuclei, one or both, have been found involved, but, from their situation, they usually escape.

Pathology.—Here as in the other cases there is hyperplasia of connective tissue, with wasting and degeneration of nerve cells and fibres, and, as a result, more or less complete paralysis of the muscles and parts supplied by the nerves concerned.

The tissues of the muscles paralyzed become more or less changed, the muscular fibres become thinner, but with preservation of the striæ, or they are affected with fatty or waxy degeneration. There is often proliferation of the interstitial connective tissue, and granular infiltration of fibres in the emaciated muscles of the tongue, pharynx, and larynx.

Etiology.—Among the causes are mentioned cold, violent emotions, excessive muscular efforts, traumatic concussions, and syphilis.

Most of the cases observed have been in persons from forty to sixty years of age, and the disease is more common in males than in females. Of two cases of labio-glosso-pharyngeal paralysis, not long since under my observation, one was in connection with diabetes mellitus, and the other came on after great mental shock and depression from the loss of property and friends—both in men about fifty years of age.

Symptomatic Phenomena.—Certain prodroma, consisting of pain in the head and neck, a sense of compression in the throat, and sometimes in the chest, especially in speaking, and rarely epileptiform attacks, precede the fuller development of the disease.

Generally the approach of the disease is gradual, difficulty of speaking and eating is experienced, and the disorder of speech is particularly noticeable in such utterances as are effected by expelling the air when the tongue is applied to the upper incisors or anterior portion of the roof of the mouth.

At length the movement and closure of the lips become difficult, the labial sounds are not well pronounced, and whispering, whistling, and sucking are no longer accomplished. Paralysis of the muscles of the palate and pharynx follows, and the posterior nares are no longer closed. Sounds in speaking, and liquids in swallowing, often pass out through the nose. The difficulty of swallowing often becomes great, and the arrest of food in the pharynx sometimes causes danger of suffocation.

The larynx is at length so much involved that the epiglottis is not

closed, and food passes into the air-passages with the usual distressing effects.

Sometimes the difficulties of deglutition precede those of speech.

In connection with these conditions there is an abundant and troublesome salivation, probably due to irritation of the salivary centre and the sympathetic nerves. There is generally feebleness of the voice from paralysis of the vocal cords, and finally the voice is extinguished.

There is sometimes anæsthesia of the pharynx and larynx, and this is occasionally early in occurrence. Irritation, hyperæmia, and a catarrhal state of the larynx may be present from the presence of particles of food and the retention of mucus. When the disease involves the origin of the pneumogastric nerve, as is often at length the case, there will be attacks of dyspnœa, often after exertion, but sometimes without, which may terminate in death.

By the irritation of this nerve the heart is made slower in its action, and it is sometimes completely arrested, thus producing death by syncope. Irregularity and excessive frequency of the heart's action sometimes finally take place from paralysis of the filaments of the pneumogastric. The motor-oculi nerves are sometimes involved, producing strabismus; and the motor branches of the fifth may be affected, producing paralysis of their respective muscles. When the lesion extends backward to the fibres of the pyramids, the upper and lower limbs, the muscles of the trunk, the sphincters, and the sexual organs may be paralyzed. Sensory disturbances sometimes take place, and reflex excitability, though varying, may be abolished.

The intelligence and the functions of special sense are unaffected, the appetite and digestion may not be disturbed, and fever does not occur unless there is some complication. Electrical excitability in the paralyzed muscles varies, but it is often normal, though it may be abolished.

This form of disease may be primary, and restricted to the bulbous nuclei; or it may be a secondary process, following degenerations of the cord; or it may be a complication in disseminated spinal and cerebral sclerosis, in softening of the pons and cervical cord, and in atrophy of the medulla oblongata. It may also complicate progressive muscular atrophy, and the symptoms will be varied by the different origins and complications which are present.

When deglutition is seriously interfered with, inanition and emaciation will follow, and in a majority of cases severe symptoms from central nervous lesions will be developed at a later stage of the disease.

Pain in the head and spine, and neuralgias of the limbs may be

followed by more general paralysis and atrophy. In the lesion at the lower centres, extending upward, the diaphragm may be involved.

Complications of spinal paralysis may occur, and a spectacle of the most wretched and utter helplessness may be presented.

The mental suffering of the patient may be expressed by his eyes alone, as he is unable to speak or move. From this there is no relief but death, which usually comes in from one to three years from the beginning of the affection. The final cause of death may be suffocation, inanition, wasting, asthenia, syncope, apnoea (from paralysis of the diaphragm or other respiratory muscles), or pulmonary hypostasis.

Diagnosis.—This is to be made by observing the symptoms which have been described. They must be long watched and carefully considered, since some similar appearances may be presented in hysteria, insanity, disseminated sclerosis, and in other localized lesions which may be recovered from.

Embolism or cerebral hemorrhage may be followed by symptoms resembling bulbar paralysis, but the sudden occurrence of symptoms of an apoplectic attack, etc., will be diagnostic.

Tumors and inflammatory processes at the base of the brain may also produce similar phenomena, but other symptoms characteristic of these several diseases hereafter to be mentioned will be present.

Prognosis.—This is the most grave possible, as all agree that the disease is progressive and the fatal result almost inevitable.

In rare cases the progress has been checked, and even improvement for some weeks has occurred, and a few doubtful cases of recovery have been reported; but the improvements, if they occur in genuine cases, will be transient, and at present we have no ground for expecting recovery, at least after the disease is well established.

Treatment.—In the early stage, when suspicious symptoms present themselves, a course intended to relieve hyperæmia and arrest inflammatory action should be adopted.

If the patient be robust, local bleeding from the neck or mastoid process, the prolonged application of ice-bags as near as possible to the part, revulsive cathartics and other eliminatives, bromide and iodide of potassium, perhaps ergot and belladonna, should have a fair trial.

Later, electricity to excite deglutition, a cold douche to the head while the patient is in a half bath, and a proper selection of food—the patient being required to take only small mouthfuls of soft substances, and to eat slowly—are advised.

A strong galvanic current along the cervical vertebræ, and along the course of the hypoglossal nerves, repeated daily and continued for a long time, will tend to produce more active movements of deglutition

and thus keep up the power of swallowing. The sympathetic and phrenic nerves may be similarly excited when their functions fail.

The hypersecretion of saliva may be diminished or arrested by atropine, best used hypodermically.

Internal medication is of doubtful use, though nitrate and other compounds of silver, preparations of iron, strychnine, phosphorus, arsenic, etc., are generally recommended. They may fulfill certain indications, though they exert little or no influence upon the progress of the central disease.

When the difficulty of swallowing is great, the last resource is the œsophageal tube, injecting food into the stomach; and even rectal alimentation may be required.

Tracheotomy has been performed in some cases where suffocative dyspnoea arising from obstructions in the larynx was present. When the disease is established, palliation is all that can be accomplished.

Acute bulbar paralysis—the result of hemorrhage in this situation, or embolism of the branches of the vertebral arteries, or thrombosis of the vessels supplying the medulla oblongata—if the lesions are not sufficient to cause sudden death, affords a better prospect of recovery than when the disease approaches gradually in the manner that has been described.

A sudden occurrence of crossed paralysis—facial on one side, and of the extremities on the other—would indicate a hemorrhage in this region or the obstruction of circulation by the pressure of a clot in some of the vessels, and the abrupt appearance of the peculiar phenomena belonging to the chronic form of labio-glosso-pharyngeal paralysis would indicate a similar cause.

The treatment would be as for cases of cerebral hemorrhage or emboli, and need not be entered upon here.

CEREBRAL TUMORS.

Most of the various forms of tumors which have been found in other parts of the body have also been found in the brain and spinal cord. Among the cerebral tumors are glioma, gliosarcoma, gummata, solitary tubercles, carcinoma, cholesteatoma, psammoma, fibroma, myxoma, lipoma, lymphoma, ostoma, angioma, neuroma, and papilloma. Besides these tumors, parasites—*cysticercus cellulosæ* and *echinococcus*—are sometimes found, and also aneurisms of the cerebral arteries may occur, producing some of the effects of these tumors.

The chief effects of cerebral and spinal tumors are produced by pressure, and are, in a general way, in proportion to their size and the

rapidity of their growth. Their special effects depend upon their location.

Besides the interruption or perversion of function caused by pressure, inflammation is apt to be excited by their presence, and by arresting circulation and nutrition in the brain non-inflammatory softening may be induced. Following these changes may be hemorrhages producing rupture of brain substance and still greater pressure. The morbid effects produced by the different kinds of tumors are not generally distinguishable from each other, and hence they may, clinically, be considered together. When, however, special forms of tumors are found in other situations where their character can be ascertained, and symptoms of brain tumors are present, there will be a presumption of a similar form in the brain; and certain diathetic affections, as the cancerous, the tuberculous, or the syphilitic, would lead to a proximate diagnosis of the character of the tumor.

General Symptomatic Phenomena.—The first stages of brain tumors present only obscure symptoms, and in rare cases none are presented during life. When the tumors are small and develop slowly, especially if situated in the hemispheres, the symptoms are usually slight or absent. Even large tumors in this situation may not perceptibly interfere with functions, while a much smaller tumor at the base of the brain may produce very positive symptoms or fatal results.

The irritation of a tumor may set up various morbid processes in the neighborhood, and even a descending neuritis may be produced. The three symptoms perhaps most characteristic are pain in the head, vomiting, and optic neuritis; but they only indicate some disease of the brain without determining its particular character. The earliest symptom is generally headache, which may be referred to different parts of the head without any constant relation to the seat of the tumor.

The pain is at first intermittent, and after a time is more severely paroxysmal, and may become only remittent.

Vertigo is also a frequent symptom in connection with the cephalalgia. The vertigo is supposed to be specially due to deviations of the lymph current in the semicircular canals of the temporal bones, produced by the pressure of the tumors, and also to lesions of the fibres of the posterior columns of the cerebellum.

The paroxysmal headaches and vertigo may be the only symptoms for months, but they are often soon followed by disturbances of sensation and motion. There may be paralysis of one region in close proximity to irritation in another, and not unfrequently the symptoms

vary from the occurrence of collateral hyperæmia or œdema, and from reflex and sympathetic irritations.

There are often painful twinges, formication, numbness, sexual abnormalities, and various nutritive changes, and sometimes alternate hemianæsthesia occurs. There are convulsive paroxysms in the paralyzed muscles, more or less decided, sometimes tonic and sometimes clonic, and occasionally general epileptiform attacks take place. Paroxysmal delirium or loss of consciousness, and a variety of abnormal mental and physical phenomena are apt to be observed, and at length these intermitting symptoms become more frequent and severe, or more constant. Galvanic excitability will vary, vision and hearing are often affected, olfaction and taste are more rarely involved, and at length paralysis of some of the functions necessary to life takes place, and death follows.

Mental disorders are not rare in cerebral tumors (they occur in about one third of the cases), and are of two classes—those of irritation and those of depression.

There may be irritability, absence of mind, hallucinations, and much agitation, and in some cases attacks of mania may occur.

In other instances there may be melancholia, somnolence, apathy, embarrassment of speech, and imbecility or amentia. These, like the physical symptoms, are generally intermitting, remitting, or paroxysmal.

Speech may be remarkably embarrassed either from paralysis of the vocal organs, or from impairment of the special organ of speech—the organ of the brain which gives the power of recalling words. The difficulty may be aphonic or aphasic—the latter is supposed to occur only when the tumor is so situated as to involve the island of Reil, or the parts which unite this with the frontal lobe and with the central and parietal convolutions.

Further observations, however, are necessary to establish this as an invariable fact, and aphonia may be produced by tumors situated in the more distant localities.

It is still a question whether particular functional centres are definitely located at the surface of the hemispheres, as there is a want of uniformity in functional results when definite and like portions of the cortical substance are stimulated, impaired, or destroyed.

Lesions of the left third anterior convolutions have so often been found in cases of aphasia, as to leave little doubt that this portion of the brain has directly or indirectly much to do with the faculty of speech; and when aphasia occurs, it may fairly be presumed that a lesion exists in the region of the island of Reil, or in parts having some connection with this locality. Even this position is questioned

by some who have had large opportunities of observation, and who have given much attention to the subject. There are those who doubt whether there is any special organ of language in the brain. This, as well as many other points of the physiology and pathology of the brain, remains to be more fully established.

In tumors of the brain the final symptoms are usually loss of voluntary motion, of automatic excitation, and of the mental functions, when coma and death are likely soon to follow.

Differential Diagnosis.—Tumors of the brain should be distinguished from *cerebral tuberculosis*, which occurs more frequently in the young and is attended by other evidences of the tuberculous state; from *chronic hydrocephalus*, which is also more frequent in children and often accompanies meningeal tuberculosis and sometimes other forms of dropsy; from *cerebral apoplexy*, which is much more sudden in occurrence and more violent in its early symptoms; from *chronic cerebral softening*, the result of chronic cerebritis or other lesions, and from *cerebral atrophy* and *cerebral hypertrophy*.

In softening, cephalalgia is less frequent, less violent, and less paroxysmal; disorders of the special senses are less marked, the psychological changes are marked by weakness rather than by excitement; there is more likely to be aphasia, contractures, and sudden and complete hemiplegia, and there are less frequently alternate and double paralysis.

Cerebral atrophy is manifested by premature decay of the mental powers, progressing to imbecility, with tremor of the lips and tongue, and of the limbs also, especially when the atrophy extends to the spinal cord. There are not the same paroxysms of pain and other symptoms in atrophy; paralysis follows the deterioration of the intellectual faculties, and the muscles are soon changed in their nutrition.

Hypertrophy of the brain more frequently occurs in children, and though of long duration, and accompanied by cephalalgia, and epileptiform attacks resembling those of tumors, there is a strong pulsation of the fontanels, the presence of a *bruit de souffle*, and a progressive expansion of the skull; and there are sometimes changes in the form of other bones.

The diagnosis of the particular position of tumors of the brain has occupied of late much of the attention of pathologists, and the observations which have been made at the bedside and in the dead house have thrown light upon the physiology as well as the pathology of this organ. There are, however, many points still in doubt and controversy, and the time has not yet arrived for full and positive statements.

The functions of various parts of the base of the brain have been ascertained with much certainty and precision, but those at the surface of the hemispheres must be regarded as uncertain, since almost every part of that surface—now one locality or portion, and now another—has been traumatically or by disease greatly impaired or destroyed, without the loss of any one function, physical or mental. The records of our late civil war afford abundant instances of extensive wounds of the hemispheres of the brain without appreciable, or at least permanent, impairment of function. I have myself attended a case where a blow from a hatchet split open the skull, cutting across the coronal suture on the left side, and wounding the brain to such an extent that two or three drachms of brain substance were discharged, and yet not the slightest impairment of speech or of any other function was perceptible, the patient, a man about thirty years of age, recovering without a symptom. In another case a young woman, laboring under a suicidal impulse, sent a pistol ball through her brain, which entered just above and behind the left ear, traversed the posterior or occipital lobe of the left cerebral hemisphere, passed upward through a portion of the right, and lodged beneath the pia mater. A scale from the ball had fallen upon the outer and upper edge of the cerebellum, producing a slight surrounding softening, but with no other perceptible effects upon function than those which were produced by the shock at the time of the shooting and the slight inflammation which followed, all of which were temporary. Insane impulses, similar to those that were manifested before the injury, returned some months after, and death two years later occurred in an insane asylum. A *post-mortem* examination showed the position of the ball as mentioned, and the opinion at the asylum was, that the injury had no effect upon the symptoms or termination of the case. As to the effect of the locality of tumors upon functions, it can without hesitation be stated that, as a rule, functions are impaired in proportion to the nearness to the base of the brain of the parts affected by the tumor.

According to Rosenthal, tumors of the convexity of the brain frequently produce convulsions and epileptiform attacks, rarely paralysis or sensory disturbances, and more frequently irritation of the parts concerned in intelligence.

Tumors of the anterior lobes are likely to produce diffused frontal headache, irritation or depression of the mental functions, convulsions and epileptiform attacks, hemiplegia, frequent disturbances of speech in the form of aphasia, but rarely disorders of sensibility and the special senses.

Tumors of the middle lobes produce effects upon the motor and intellectual functions similar to those of the anterior; but there is

likely to be more disturbance of the special senses, particularly of sight; and cutaneous anæsthesia upon the side opposite the tumor, affecting one limb or half of the body, is still more frequent.

In tumors of the posterior lobes, according to Rosenthal, physical disorders are much more common than in those of the anterior or middle. The motor disturbances are convulsive and epileptiform; depression is manifested by incomplete hemiplegia or paresis of certain limbs; cephalalgia is usually diffuse, but sometimes limited to the posterior part of the head, and vertigo is perhaps still more common.

In tumors of the cerebral motor ganglia (corpus striatum and lenticular nucleus) hemiplegia is common, often preceded by muscular excitation; convulsions, disorders of speech from affection of the vocal organs, facial paresis, disturbances of intelligence, and comparative freedom from disturbance of the organs of special sense will be frequently present.

The diagnosis of tumors in the optic thalamus and tubercula quadrigemina is obscure. The most striking symptoms are convulsive spasms, paralysis of the limbs and of the motor-oculi nerves, changes in the conditions of the pupils, paresis of the face, and frequent disorders of vision.

Tumors of the middle cerebral fossa, and of the region of the Gasserian ganglion, are marked by chronic head symptoms, facial neuralgia, often changing to anæsthesia, and limited to one half of the face; simultaneous paralysis of adjacent motor nerves, or the anterior sensory nerves; peculiar electrical reactions upon the paralyzed side of the face, and finally, inflammation and suppuration of the eyeballs. The appearance of hemiplegia of motion and sensation in the limbs, with crossed paralysis of the cranial nerves, disorders in the articulation of speech, dysphagia, and partial rotation of the head or trunk to one side, shows that the tumor has extended to the pons, and, varying with the symptoms, to the cerebellar peduncle. (Rosenthal.)

Tumors in the pituitary region, when of considerable size, involve or press upon a variety of parts and affect different functions.

When they extend to the fourth ventricle diabetes may result, and different parts being involved many symptoms may be produced.

Frontal headaches, disordered vision, flashes of light, spectra, amblyopia and amaurosis, roaring in the ears, enfeeblement of the sense of smell, exophthalmia, and strabismus may result. Tumors of the cerebral peduncle present the symptoms of cephalalgia, vertigo, alternate hemiplegia with sensory disturbances, paralysis of the motor-oculi nerve upon the same side as the tumor, and also often on the

other side, frequent neuro-retinitis, difficulty of micturition, abnormal temperature, but absence of mental disturbance.

Tumors of the pons Varolii seldom produce convulsions, but there is crossed paralysis of motion, and often of sensation, frequent abolition of the farado-muscular contractility, and increase of the galvanic-muscular reaction, with complete unilateral facial paralysis, disorders of the senses, particularly of vision; difficulty of articulation, frequent dysphagia, and converging strabismus.

The cerebral peduncles have intimate anatomical relations with the pons and the cerebellum, and tumors of these parts produce symptoms similar in many respects to those of the parts with which they are so intimately connected. There are headache, vertigo, disorders of special senses, hemiplegia, unsteady gait with a tendency to fall upon the side, and partial rotation around a vertical axis with lateral rotation of the head.

Among these the involuntary rotation around the axis of the body is most characteristic of this localization.

Tumors of the cerebellum are chiefly characterized by occipital headache, convulsions of an epileptiform character, oscillations, uncertainty of gait, intense vertigo, indications of rotatory movements, amblyopia or amaurosis, convergent strabismus, and absence of psychological disorders.

It should be borne in mind that in few of these cases can the diagnosis be positive either as to the character of the lesion or its location. A lesion of one part of the brain may, by its sympathetic connections with other parts having different functions, manifest symptoms produced by the organs sympathetically affected. So far as this is the case it must prevent the positive localization of lesions by symptoms, at least until the sympathetic relations of the different central organs are far better understood than at present. This, together with the uncertainty as to the localization of many functions, and the doubt as to their limitation to any particular part, throws a shadow of obscurity upon the whole subject of the diagnosis of the situation of tumors and other lesions. That such obscurity exists is established by the fact that statements on many points differ, made by those who have had equal opportunities of observation, and who with equal zeal have pursued experimental investigations. It scarcely needs to be mentioned that where tumors occupy several lobes at the same time, the distinctions as to localities disappear.

Ophthalmoscopic observations are uncertain, not only as to the locating but as to the character and even existence of cerebral lesions, and must not be too much relied upon. The retina may be diseased, may be hyperæmic, anæmic, normal, or in other conditions, where the

brain is not in a corresponding state ; still, an approximate diagnosis can usually be made, and sometimes a very positive one, by means of the ophthalmoscope.

Diathetic tumors of the brain can usually be distinguished by the history of the case and the concomitant conditions.

Prognosis.—The *prognosis* in all forms of cerebral tumors is grave, though their continuance and the severity of the symptoms vary greatly.

There is seldom any possibility of directly reaching them either by medical or surgical means, and their course is usually progressive. Scrofulous or tubercular deposits in the brain, as in other internal organs, are exceedingly unpromising, and cancerous growths here are fatal.

Syphilitic growths or deposits afford more ground for hope, and when that diagnosis is made, a thorough antisyphilitic course of treatment should be instituted.

Treatment.—As the ordinary tumors of the brain cannot be removed, the objects of treatment are, *first*, to arrest their growth, and if this is not possible, a retardation of their growth, the checking of the progress of the disease, and palliation of the symptoms should be aimed at.

The general health should be conserved, and, if necessary or possible, repaired. Irritation, inflammatory and hyperæmic conditions in the neighborhood of tumors are often present, and when the symptoms indicate this to be the case, bromide of potassium, iodide of potassium, ergot, and belladonna, and possibly counter-irritation, may be of use.

In conditions of anæmia of portions of the brain and the general system, tonics, iron, quinine, and strychnia may be indicated. For the paralyzed parts, frictions, massage, and electricity will often be of service. For controlling convulsions and other violent symptoms, the bromides or chloral hydrate may be required.

The *Parasites*—*cysticerci* and *echinococci*—may appear in the brain, though more rarely than in some other organs, but the consequences are more serious.

The *Diagnosis* is not easy; but if brain-tumor symptoms appear in one who has had tænia, or who has been particularly exposed to the parasitic causes, or if there is loss of substance in the bones of the skull, or a circumscribed tumor appears, hydatids may be suspected, and an exploratory puncture may demonstrate the character of the disease. Hydatids in the head of sheep have been successfully treated by puncture with a trocar through the ethmoid or some soft part of the skull.

Trephining and puncture have been suggested for human patients, but the uncertainty of diagnosis as to the character of the disease or its locality has prevented the adoption of the practice.

A fatal result has almost inevitably followed parasitic tumors, and generally within a year and a half.

MÉNIÈRE'S DISEASE.—AURAL VERTIGO.

This is a disease characterized by sudden attacks of vertigo in connection often with deafness, though sometimes with acute hearing, ringing, or other noises in the ear, faintness, pallor, nausea, and often vomiting. The symptoms are intermitting, the attacks usually brief, consciousness is retained, but there is a feeling of approaching syncope, sweating follows, the pulse is extremely rapid, and when vomiting occurs the attack usually comes to an abrupt close. The paroxysms are infrequent at first, but they afterward come nearer together, and in time vertigo becomes nearly or quite constant.

Pathological investigations have shown that these symptoms are dependent upon lesions of the semicircular canals, probably affecting that portion of the brain concerned in audition.

In various affections of the middle ear momentary attacks of giddiness are not uncommon, passing off, however, with the subsidence of the aural trouble. In these attacks the symptoms resemble those of Ménière's disease, but in the latter the symptoms usually persist until deafness occurs, when not only the paroxysms but the more constant giddiness and other symptoms cease.

The treatment of Ménière's disease will be that of inflammation of the internal ear. The vertiginous attacks are relieved but not prevented by the patient's lying down and being protected from noises and other disturbances. Derangements and loss of power in other respects may accompany this affection.

DISEASES OF THE SPINAL CORD.

An understanding of the morbid conditions of this part of the nervous system must be preceded by a particular knowledge of its anatomy and physiology.

Modern investigation has done much in throwing light upon the obscurities which but a few years since rested upon both the physiology and pathology of the spinal cord, but there are still some points remaining in doubt which the future must determine. Although the

reader is supposed to have a knowledge of the physiology of all parts of the body before attempting to study its pathology, reference here to some physiological facts may aid in a more ready comprehension of the morbid conditions to be described.

The spinal cord has on each side an anterior, a lateral, and a posterior column. Each of these has some peculiarity of structure and marked difference of function. Between the sides there is an anterior fissure and an anterior and posterior commissure or connection, and there is a small central canal. In the central part of the cord is a quantity of gray matter in the form of a double crescent, and the horns of these crescents extend into the anterior and posterior columns, and are connected respectively with the anterior and posterior roots of the spinal nerves.

Nerve roots issue from the anterior and posterior columns. Those from the *anterior* are efferent or motor in their function, and those from the posterior are afferent or sentory. These nerve roots from the different sources unite, after passing a short distance, to form a compound nerve, which is distributed to the parts below its origin in the cord.

The anterior horn of the central gray matter is connected with the anterior or motor nerve roots of the anterior column, while the posterior horn is connected with the sentory nerve roots of the posterior column.

Impulses from the brain—efferent or motor impulses—pass down the cord ordinarily and chiefly through the anterior column, from which the motor roots emerge.

The sensory or afferent impulses are conveyed up to the brain chiefly and ordinarily through the posterior column, from which the sensory nerves emerge. However, the horns of the central gray matter, extending to the anterior and posterior columns and nerve roots respectively, afford opportunity for the conveyance of impulses through the gray central matter, and it is found that these impulses are not confined to a single course. It is also found that the efferent or motor impulses from the brain to the muscles pass down the column on the same side on which the muscles they influence are situated. Thus a lesion of the right anterior column, interrupting the motor influence from the brain, will cause paralysis of the right side below the lesion, but not, or only to a slight extent, of the left.

The same is true of the other side. With the afferent or sensory impulses the case is different. There is a decussation of the nerve fibres, so that sensory impressions made upon the right side of the body are conveyed to the brain through the left column of the spine; and a lesion of the left column, interrupting the passage

of the sensory impression to the brain, will cause loss of sensation on the right side of the part below.

A lesion of one lateral half of the cord will thus produce paralysis of motion on the same side, and paralysis of sensation on the opposite side. But there are other impulses sent through the cord than those of mere voluntary motion and common sensation.

There are vaso-motor impulses, inhibitory, secretory, trophic, calorific, etc., the course of which is not so well understood. Indeed, as already stated, there seems to be more than one track for motor and sensory impulses, and the same is probably true, and perhaps to a greater extent, of other impulses or influences.

It is thought by some that there is a distinction between the paths of the common impressions of touch and of painful impressions. The common tactile impressions are supposed to be conveyed through the posterior columns, while painful ones are conveyed by preference through the central gray matter.

As illustrated in locomotor ataxia, the influences which produce correlation of motion and certain reflex actions are, chiefly at least, conveyed through the posterior columns. But in regard to spinal, as well as to cerebral physiology and pathology, further observations and experiments are required.

Spinal lesions and their particular localities are manifested by a variety of symptoms. There are changes in sensation, motion, and in the reflex, circulatory, and trophic functions. As a rule, the symptoms commence with signs of irritation, but when persistent, evidences of depression follow. From the sensory functions come pains, hyperæsthesia, formication, and various perversions of feeling.

The pains vary in character and affect different parts. A distressing sense of vibration may follow slight irritation, and formication is common when moderate compression is made upon the sensory nerve roots.

Sensory depression is indicated by dullness of sensibility or complete anæsthesia, and tactile sensibility may be depressed or lost, while a sense of pain, of coldness, or of heat is felt. There will often be different degrees of sensibility to different kinds of impressions. Various modes of objective examination, such as touching with sharp points, pricking more deeply with a pin, touching with surfaces having different characters of hardness or softness, roughness or smoothness, etc., may be tried.

Tactile sensibility and notions of space may be tested so as to be recorded by an æsthesiometer, and a sense of resistance by placing weights upon the parts.

Faradization and different forms of electrical excitement will test

different kinds of sensibility, and also reflex excitability; while mechanical irritations—tickling, striking, etc.—will also determine the amount of reflex activity. In a majority of cases, as depression progresses, sensibility to tickling disappears first, then to contact and pressure, then to temperature, and lastly to pain.

There is, however, no uniformity in these respects. In morbid states of the motor functions there are spasms, tremors, muscular stiffness, contractions, and tetanic and epileptiform attacks. But paralysis—loss of the power of voluntary, and at length of any kind of motion—is the ultimate and extreme condition. In this spinal paralysis the sensory as well as motor functions are often lost, the sphincters of the bladder and rectum are apt to be involved, and the control of these organs lost. In some cases with loss of motion and impairment of common sensibility there may be some pain, especially where there is slowly increasing pressure.

Unilateral spinal paralysis from pressure is not common, as pressure affecting one side of so small a body is apt to involve both.

When the lesion is cervical, the arms alone, or chiefly, may be affected, and occasionally, for reasons explained, there may be paresis on one side and anæsthesia on the other.

Alternate spinal paralysis may take place where the arm of one side and the leg of the other are paralyzed, depending upon a localized lesion of the pyramids involving the nerves of the upper limbs before, and those of the lower after crossing. All the limbs may be affected, but in different degrees; and indeed there may be every variety of change—sensory, motor, trophic, and reflex—from the different special lesions which may take place. Changes of temperature, of circulation, of perspiration, and of nutrition, as well as of motion and sensation, may occur. However much the sympathetic system of nerves may have to do in controlling circulation, the cerebral and spinal nerves, either by their connection with the sympathetic or independently of them, have much to do in influencing the calibre and the action of the vessels and the circulation of the blood.

Participation of the brain in diseases of the spinal cord sometimes occurs, the morbid process extending from the cord to the brain.

In a case lately under my care, where from a fall and blow upon the cervical part of the spine all the limbs were paralyzed, paroxysms of calorific changes soon took place, followed by fatal involvement of the functions of the brain. Dysphagia, dyspnœa, spasms of muscles of the face and throat, coma and death followed.

Not only may lesions of the cord be followed by those of the brain, but the latter may give rise to the former.

Thus cerebral apoplexy and softening may be followed by degen-

erations of the cord; and diffused sclerosis affects both the brain and the cord.

These general statements will aid in the understanding of the various special diseases of the spinal nervous centres.

SPINAL HYPERÆMIA.

The spinal cord as well as the brain is subject to hyperæmia. This may be active or passive. The former comes on suddenly and is of a more sthenic character; the latter is slower in access and in its course. The pathological importance of increased and diminished quantities of blood in the spinal cord is a subject upon which there are differences of opinion. As simple congestion of the cord is seldom or never a direct cause of death, pathological anatomy has thrown less light upon the subject than upon most other spinal affections. Were opportunities for *post-mortem* examinations more frequent, they would be unsatisfactory, as the amount of blood in various parts, before and after death, where no other pathological changes have taken place, by no means always corresponds.

Morbid Anatomy.—The morbid anatomy will, however, present features similar to those of hyperæmia of the brain. The gray matter will usually be of a darker color than in health, and the vessels will be enlarged. The white matter is of a more pinkish hue. The congested condition may be confined to limited portions of the cord, or may be more diffused. Generally some points are more affected than others. Examined minutely, the congested parts will be found to have undergone little change excepting the enlargement of the vessels. The capillaries are distended, and sometimes slight effusions are found under the vascular sheaths and in other situations. The vessels of the membranes are usually engorged, and small ecchymosed spots in different situations can sometimes be observed, and the cerebro-spinal fluid is often increased. The tortuous course of the veins and the absence of valves favor these congestive conditions, and the pressure of the distended vessels produces irritation and interferes with the functions of the cells and fibres of the cord.

As opportunities for post-mortem examination in simple uncomplicated hyperæmia have not been frequent, some of the appearances noted may have been due to other accompanying conditions.

Symptomatic Phenomena.—The symptoms and course vary. In the more acute and sthenic forms of spinal hyperæmia the patient feels a sense of weight in his limbs, or as if they consisted of some hard and comparatively insensible material. He has a sense of weak-

ness, sometimes amounting to an inability to move, at least with any degree of freedom. He has a general sense of oppression, especially when the congestion is high in the cord, and a feeling of suffocation may be experienced. Tactile sensibility is retained, the pricking of a pin is often acutely felt, and there is at least the usual appreciation of changes of temperature. Generally there is a sense of coldness in the extremities, calling for more warmth or additional clothing, and the temperature is actually reduced, sometimes markedly. Erections are apt to take place, especially when the patient is in a supine position. There is pain in the back, often running down the thighs, which is generally relieved by lying upon the face or side. The mind is usually clear, but there are restlessness and want of sleep; there is usually constipation, but control of the rectum and bladder is generally preserved. There is, in short, a greater or less degree of paralysis, particularly of the lower extremities. Reflex action is generally diminished, but electro-muscular contractility is often increased. When the paralysis is so great as to confine the patient to his bed, the muscles waste from disuse. Both lower extremities are usually affected, but irregularities occur; sometimes only one may be involved, while at others the loss of power becomes more general, affecting the upper extremities and most of the parts supplied by spinal nerves. The spinal pains are generally increased by warmth, and cold applications are grateful; and the symptoms are increased by lying upon the back, and, when the lower part of the cord is involved, by standing; but the pain is not increased by motion, as is the case in spinal meningitis. Bed-sores seldom result, and the duration of the acute attack, though variable, is not commonly longer than six weeks. Attacks, however, may be repeated, and the acute variety of the disease may end in a chronic form.

In cases *Subacute* or *Chronic* from the beginning, the access is slow and the symptoms are not so strongly marked. There will, however, be heaviness, and often tingling in the limbs, especially after standing or walking for a time, and there is a tired and uneasy feeling which a change of position may relieve. There are sometimes sensory changes in the skin, but they are not common; a feeling of constriction around the body is sometimes felt, and there are vague pains in the back and limbs. Feelings of oppression and suffocation are sometimes experienced as the condition approaches the more severe or acute form. In all varieties of spinal hyperæmia, especially the more acute, alcohol, strychnine, phosphorus, and other agents believed to increase the amount of blood in the cord, aggravate the symptoms and afford hints as to causes and treatment.

Etiology.—The Causes of spinal congestion are various. The

severer forms are more common in women, and are often found in connection with uterine and ovarian derangements. Standing for a long time tends to its production in men, and this cause affects women as well. Car-drivers and shop-girls are said to be particularly subject to spinal congestion.

Excessive venery, alcoholic intemperance, suppression of habitual discharges, portal congestion, constipation, exposure to severe cold, working in compressed air, obstructed circulation from disease of the heart or lungs, cirrhosis of the liver, the pressure of the gravid uterus or of abdominal tumors, the long maintenance of the dorsal decubitus, and malaria, are among the causes of the affection. The acute congestion of the spine which ushers in the exanthemata or other fevers may result in the more chronic forms of the disease.

Diagnosis.—The Diagnosis is a matter of importance, and sometimes of some difficulty. It may be confounded with spinal meningitis, with myelitis, and with spinal irritation. It has symptoms more or less in common with these, with degenerative changes and tumors which occur in the cord, and with diseases of other organs—urinary, sexual, etc. It is distinguished from *Spinal Meningitis* by the increase of pain on motion in the latter, and by the rigidity of the muscles not usually present in simple congestion. The symptoms in myelitis are more severe. In the latter there is apt to be more complete anæsthesia, wasting, loss of electric and reflex excitability, incontinence of urine and fæces, and the occurrence of bed-sores. These very rarely exist in simple congestion.

In *Spinal Irritation* there is less loss of power, more tenderness on pressure; and other affections, such as hysteria and general anæmia, are more likely to be present.

In *Sclerosis* and other degenerative changes there is much more persistence in the symptoms, and they have peculiarities which are elsewhere pointed out.

Prognosis.—The prognosis in simple hyperæmia is favorable under early and proper treatment. When it precedes myelitis, or when it accompanies, as it often does, other diseases of the cord, it may long be kept up and produce many of the symptoms which are observed in such cases. It may also be the cause of various changes of a more permanent or dangerous character.

Treatment.—The attention should at once be directed to the causes which produce the congestion, and when discoverable they should, if possible, be removed. Portal congestion, constipation, uterine derangements, oxalæmia—whatever may be injuriously affecting the system—must be remedied. Rest is often important, especially

when the disease is caused by remaining long on the feet. Elimination by cathartics, diuretics, and diaphoretics, especially the two former, is often of great service. Alcohol, strychnine, iron, and other tonics, so often prescribed without proper discrimination, are contra-indicated and may do much mischief.

In acute cases, especially when dependent upon the suppression of an accustomed flux—hemorrhoids, menstruation, etc.—blood-letting either general or local is indicated; and even in less plethoric cases wet cups along the spine, or leeches to the anus or uterus, or dry cups extensively applied, will often be followed by speedy relief. The application of cold to the spine after the use of cups, wet or dry, as the general state may indicate, is not only grateful to the patient's feelings, but useful in diminishing the congestion. Chapman's ice-bags, or cold compresses often changed, or the ether spray, are the modes of its application. Counter-irritation is often useful, especially in the more subacute varieties, or at a later period of the acute. The patient if in bed should be prevented as far as possible from lying on the back, a moderate diet should be enjoined, and cathartics, generally saline, should be administered. The special internal remedies, however, are the bromides, or hydrobromic acid, in free and continued doses, ergot in full doses, or belladonna. The bromide of potassium, especially where there is irritability or restlessness, may be freely and somewhat persistently used. Iodide of potassium may often be added with advantage, especially where nutritive changes are suspected. Ergot, belladonna, and iodide of potassium in combination is a favorite prescription of Dr. Brown-Séquard, especially where hyperæmia accompanies other pathological conditions; and the combination is often very useful. Ergot is advised in free doses. Drs. Brown-Séquard, Hammond, Jacobi, and others strongly advocate this article, and in order to realize its full effects, a drachm of the fluid extract should be given three times a day. Belladonna has the reputation of diminishing the vascularity of the cord, and may be given in doses sufficient to produce its perceptible effects. The hot douche is advised—water at 98° F., poured from a moderate height upon the back—and other hydro-therapeutic measures may be tried. Electricity in very passive cases may be used, the constant current is said to be best, the positive pole being applied to the upper part of the lesion and the negative rubbed up and down all the parts below. It, however, should be used with great care, and but for a few minutes at a time, especially at first, and its effects should be watched. The upward current is said to aggravate the symptoms. The induced current applied to the muscles will aid in keeping up the nutrition. Strychnine and phosphorus, especially in the more acute forms, are contra-indicated. They may

possibly be useful in very advanced stages or chronic forms, but they should generally be regarded with suspicion.

MYELITIS.—SPINAL INFLAMMATION.

Myelitis or inflammation of the parenchyma of the spinal cord presents various forms. It may be either acute or chronic, and its results are widely different, depending on its acuteness or chronicity. In its acute form the destructive inflammatory process predominates—acute inflammatory exudates, suppuration, and softening are the leading features—while in the chronic form the constructive process prevails—hyperplasia of connective tissue (though there is degeneration of the cells and nerve tubes)—and hardening or sclerosis results. The two classes of changes are sometimes combined in the same case—some points being hardened while others are softened.

In some cases the inflammation affects chiefly the connective tissue of the cord, including its more immediate envelopes, while in others the proper nerve matter—the gray columns and the proper conducting material of the cord—are the chief or primary seat of the inflammation. In most cases, perhaps, both of the elements of the cord are involved, though generally one is affected more than the other.

Morbid Anatomy.—In *acute parenchymatous myelitis* the pathological anatomy has been carefully studied. In the beginning of the inflammation the medullary tissue is swollen, with increase in the size of the vessels and the cells of the neuroglia or connective tissue; there is hyperplasia of the reticulum, dilatation of the axis cylinders, and very marked hypertrophy of the cells of the anterior horns. At a more advanced stage exudative softening of the basement substance occurs, with formation of pus globules and granular cells at the expense of the neuroglia; granular degeneration of the nervous and interstitial tissue, and fatty and pigmentary atrophy of the nerve cells. In the extremely rare cases where recovery has been known to take place, absorption of exudations and retrogressive metamorphosis have occurred, and cicatrices or cysts have been found. (Rosenthal.)

When rapid destructive changes of the centres of the cord occur, they are promptly followed by degeneration of muscles. The muscles assume a reddish tawny color, are softened and friable, and sometimes dry and brittle. Fatty degeneration has sometimes been observed, and also slight changes in the muscular nerves, and in long-continued cases atrophy of the muscles follows.

Causes.—Most cases of acute myelitis are produced by injuries, blows upon the back, concussion on the part, etc., but it may be due

to violent chills or excessive exertion. Tumors of the cord and other more chronic structural changes may induce acute inflammatory attacks. Sex has no special influence, and sexual excesses are not proven to produce acute inflammation of the cord.

It is most frequent in young adults.

Symptoms.—The symptoms of acute myelitis will vary with the extent and the particular locality of the lesion. When developing in the gray matter of the cord it commences with fever, severe pain in the part, with *girdling* pains extending around the body, severe pain in the muscles—especially on movement—and loss of electro-muscular contractility, soon followed by complete paralysis. There is generally at an early period increase of temperature in the paralyzed limbs, followed by the disappearance of sensibility and reflex excitability. The urine and fæces, at first retained, soon pass off involuntarily; trophic changes soon follow; bed-sores are common and early; decomposing alkaline, and often bloody urine passes; and œdema of the paralyzed limbs and effusion into the joints may take place. Death, when early, may occur in a few days or after a month or two. This usually is the result of the ascending progress of the disease, which often induces paralysis of the respiratory muscles and consequent asphyxia. When death takes place later, it may occur from cystitis, bed-sores with symptoms of pyæmia, or from meningitis, hypostatic pneumonia, or marasmus. When the inflammation is limited in extent the symptoms are less severe and less rapid in their course. The fever is not as marked, symptoms of motor and sensory irritation are longer continued, reflex and electrical sensibility is only diminished, and the paralysis of motion and sensation is less complete. The trophic disorders are also less, and the disease may pass into the chronic stage.

When the lesion is high in the cord, the pain will be in the neck. There will often be irregularity of the pupils, with more or less paralysis of the upper extremities; and dyspnœa, dysphonia, irregularity of the heart's action, distress in the region, etc., are likely to occur. When the lesion is in the lumbar region, the lower limbs, bladder, and rectum are specially involved.

Diagnosis.—The diagnosis of acute myelitis in well-marked cases is not generally difficult. When the disease rapidly extends to the upper part of the cord and the medulla oblongata it has been called *acute ascending paralysis*, and commonly proves fatal from asphyxia. This rapidly extending form of paralysis sometimes disappears as speedily as it is developed; and in some fatal cases no morbid changes have been discovered, even on careful microscopical examination. A traumatic case of this kind has lately been under

my observation. It cannot always be distinguished from more decided or ordinary forms of myelitis.

Inflammation of the membranes of the spinal cord is marked by early stiffness of the vertebral column, especially at the neck, by the cutaneous and muscular hyperæsthesia, the more tardy appearance of paralysis, and the continuance of electrical reaction. It is sometimes very difficult to distinguish myelitis from hemorrhage into the substance of the cord, and, indeed, such hemorrhage is apt to follow myelitis.

Hemorrhage not preceded by inflammation will be sudden in its occurrence, and the symptoms of inflammation are likely to follow.

Hysterical paralysis will not be attended by the same amount of pain and fever, will be accompanied by other hysterical symptoms, will present differences in the phenomena excited by electricity, and the general symptoms will be less profound.

Prognosis.—The prognosis of acute central myelitis, as will be inferred from what has preceded, is very unfavorable. When confined to circumscribed points it is less unfavorable to life, though impairment of function is likely to continue; serious traumatic lesions have been repaired, and in some of the lower animals a complete section of the cord has healed by first intention. Repair in man is, however, unusual; and a slight injury followed by myelitis, if it does not prove fatal, is seldom followed by complete restoration of function.

Treatment.—The treatment of myelitis will not materially differ from that of spinal meningitis and of acute spinal hyperæmia, already described, or of simple spinal meningitis, to be mentioned.

An antiphlogistic course adapted to each case will be required; often local, and sometimes general depletion will be called for; cold may be applied to the part, and, later, counter-irritation. Belladonna, ergot, and the bromides are the chief internal remedies, and electricity and strychnine should be avoided while inflammatory symptoms are present. The iodide of potassium is recommended as effusions and nutritive and structural changes advance; and, in short, the treatment of the active form of the disease should be conducted on the same general principles as in cases of spinal meningitis, described in another connection. Indeed, the two conditions are often combined, and the disease might be more properly termed *inflammation of the spinal cord and its envelopes*. In the paralysis which results great care should be taken of the bladder, and also to prevent bed-sores. For this latter purpose patients have been placed in a tepid bath, and kept there for long periods.

In Vienna, Berlin, and elsewhere in Germany, during the summer of 1880, I saw several patients with paraplegia dependent upon mye-

litis who had been constantly kept for several months in water a little below the temperature of the blood, some for about a year, with alleged improvement of their symptoms. They were free from bed-sores, and appeared entirely comfortable in their new element, and, different from what might have been supposed, the cutaneous circulation seemed satisfactory.

When bed-sores occur, as is so often the case in severe myelitis, even when the utmost care is observed, the continuous bath may be an essential mode of treatment. A small stream of warm water must be kept flowing into the bath while another is passing out, the head must be properly sustained on a hair pillow and rack, an impervious cloth should be placed over the tub to prevent evaporation, and blankets over that to confine the heat. Arrangements must be made for lifting the patient from the water when the evacuations occur, and care must be taken to keep the water at a comfortable and uniform temperature.

CHRONIC MYELITIS.

Chronic Myelitis usually results in sclerosis of the cord. It is slow and insidious in its onset, and the particular symptoms attending its progress will depend upon its special locality, its severity, and its extent.

It is divided into primary and secondary forms. In primary myelitis the disease commences in the tissue of the cord, and is produced by repeated congestions, by continual stimulation of the nerve fibres and cells, and by all the more remote causes which may contribute to these results. They have already been considered in a general way, and are more particularly attended to under the heads of the different forms of sclerosis mentioned elsewhere.

When chronic myelitis is the result of the acute form of the disease, softening and other results of the preceding state may be mingled with the effects of the chronic disease; but when it is chronic from the beginning, sclerosis is the common condition induced.

Etiology.—The causes of chronic myelitis are often obscure. Debilitating social conditions, excessive exertion and exposure, suppression of the menses, the application of intense cold, concussions such as occur in railway accidents or in long-continued railway travel, mental shocks—especially from fright, and inflammation of the brain or of nerves extending to the cord, are reckoned among the causes.

The various conditions which produce hyperæmia of the cord will often cause inflammation as well. It is rather more frequent among

men than women, and the largest number of cases is found in middle life.

Prognosis.—In chronic primary myelitis the prognosis is grave. In the severer cases a fatal termination may occur in from one to three years, while the milder forms may continue six, eight, or even twenty or more years. Bed-sores, cystitis with pyelitis, general wasting, hæmaturia, pneumonia, tuberculosis, and other intercurrent diseases are the usual immediate causes of death. In secondary myelitis the inflammation is due to diseased processes external to the substance of the cord, to disease of the vertebræ, to interspinal neoplasms, to inflammations or hyperplasias of the membranes, etc.

The extent of the inflammation will vary the prognosis. The inflammation is sometimes confined to a part of the transverse diameter of the cord and to a short longitudinal space, while in other cases it is more extensive longitudinally, or it may occupy a large part of the transverse diameter.

In these cases the disease and its resulting paralysis are produced by compression and the extension of disease to the proper substance of the cord. The cause of this compression has less effect upon the symptoms than the situation and extent of the pressure, and the amount and character of the morbid change induced. At the point of pressure the cord is atrophied, generally hardened, and the nerve fibres are to a greater or less extent destroyed. Degeneration is apt to follow the column of the cord pressed upon, either in an ascending or descending direction, and may follow certain fibres along the whole extent of the cord, and along the nerve roots that issue from it.

Symptoms.—The symptoms constituting the clinical history of these cases may vary much. More frequently the first symptoms are disturbances of sensation. They consist of feelings of constriction, of numbness, tingling, itching, etc. They are produced by irritation of the roots of the nerves at their origin in the gray substance, and as they pass outward to their destination. Abnormal conditions of cutaneous sensibility will be observed. According to the region pressed upon and the amount of pressure, there will be retardation of perception, or irradiation of sensibility, hyperæsthesia, painful anæsthesia, or entire loss of sensation. The motor nerves may soon be involved, producing diminution or loss of muscular power; or spasms, rigidity, contractures, epileptiform attacks, etc. Some of these abnormalities depend upon the interruption of inhibitory influences from the brain, the cord failing in its conducting functions. These convulsive actions of the limbs have been called by Dr. Brown-Séquard *Spinal Epilepsy*, and by others reflex *Spinal Spasms*. According to the experiments of Dr. Séquard, the centre of these phenomena is in

the medulla oblongata, and the cord only serves, or fails to serve, as a conductor. The lesion at first may be unilateral, and the paralysis or spasms may be confined to one limb, or there may be cross paralysis; but the most common form is paraplegia, especially where compression produces the effect. When, however, the myelitis is in the cervical region, paralysis first occurs in the upper limbs, and later in the lower. The upper extremities are thought to be more sensitive to morbid impressions than the lower. Atrophy of the cells from exudates and other forms of pressure may run an acute or a chronic course, producing varieties in the clinical phenomena. The roots of nerves may be involved or pressed upon, or they may become diseased in their course—the inflammation disturbing functions in different ways.

Diseases of the vertebræ, caries, fractures, dislocations, atrophy from compression, cancerous disease, various neoplasms, syphilis, etc., may not only cause myelitis and its consequent symptoms, but may produce other phenomena peculiar to each lesion. They are not, however, sufficiently marked and uniform to require for each here a detailed account.

The pathological changes limited to certain regions of the cord, producing particular trains of symptoms, will require separate notice.

Treatment of Chronic Myelitis.—The treatment of secondary forms of myelitis—those depending on disease of the vertebræ, syphilis, etc.—will be influenced by the original affection. In Pott's disease suspension and the plaster jacket, or other mechanical means, will be important. In syphilitic cases antisymphilitic remedies must be actively pushed, and whatever other diseased condition is present must receive attention. If strumous or other diathetic conditions are observed, the proper remedies must be applied. Spinal fractures, dislocations, exostoses, and other diseases of the bones, come within the province of surgery. Tumors of the cord and various neoplasms do not admit of radical treatment, but symptoms of irritation and inflammation may be mitigated by the various means, many of which have been described. It is the present fashion in Germany and France to advise different modes of hydropathic treatment, and benefit is often derived from water. Packs, cold or warm, general or local, douches, etc., adapted to the conditions of each case, may be tried. The treatment of primary chronic myelitis, when the disease is advanced, is generally unsatisfactory. In the early state the remedies advised in spinal hyperæmia and in the more acute forms of myelitis may be more efficient. Rest, as nearly absolute as possible, and often long continued, is an important element. All active exertion must be avoided, and the patient should lie as much as possible upon the side or face. Wet cups, counter-irritation, cathartics, ergot, bel-

ladonna, bromide of potassium, and hydrotherapeutic measures may be of decided service if sufficiently and perseveringly applied. The iodide of potassium is certainly worthy of a continued trial, but it is more efficient in subacute meningeal inflammations and exudations than in hyperplastic processes in the parenchyma of the cord.

Strychnine is generally contra-indicated, from the hyperæmia it induces. Electricity must be used with the greatest caution, if at all, and chiefly in the milder forms. When symptoms of irritation are present, it is commonly contra-indicated. It is thought to be very useful in some very chronic and advanced cases, and may be tried, its effects being carefully watched. Mild continuous currents should be used daily, and for short periods at a time. Thermal mineral waters have a reputation and may be tried. Hydrotherapeutic measures here again have strong advocates among those of high authority in the profession. That the application of water has much effect upon the numerous sensitive nerves of the skin, and that impressions may be conveyed through them to the brain, the cord, and the vaso-motor centres, and may thus modify circulation and other reflex actions, there is no doubt. In proportion as the application of water diminishes or increases the vascular currents in the skin, the mean pressure of the blood and the number of globules which carry oxygen to the other organs will increase or diminish, and will thus exert much influence upon their nutrition. The heat of the body is strikingly modified by the bath, as water has a refrigerating power twelve times greater than the air at the same temperature. These properties make water a powerful perturbing agent, and its judicious use may be of great service in many diseases; and in chronic myelitis, so little influenced by other agents, it is worthy of trial. It is difficult to give precise rules for its use, as so much depends upon the effects observed; but wet packs, friction with wet cloths, cool baths, warmer baths, hot douches, etc., so managed as to bring the blood to the surface, primarily or secondarily, will tend to the relief of the spinal hyperæmia, and may modify the nutrition of the cord favorably.

Nitrate of silver and chloride of gold have been recommended, but their good effects can scarcely be said to have been demonstrated. When the period of depression arrives, various tonic and nutrient articles will be useful in keeping up the general nutrition. Codliver oil, the lactophosphate of lime, a light but nutritious diet, fresh air, etc., will be useful. The paralysis of the bladder may be relieved by introducing a button electrode into the rectum, and applying the other electrode over the pubis. The urine is apt to decompose in the bladder, and in many cases it is necessary to draw it off with the catheter from time to time, and to wash out the bladder. Great care

as to bed-sores will be required here as in acute cases. The alternate application of heat and cold to the spine is thought to have an effect preventing and healing these very troublesome complications. The continuous bath here, as in the more acute cases, is worthy of consideration.

SPINAL MENINGITIS.

The membranes of the spinal cord, a continuance of those of the brain, are subject to inflammations of a similar character. They may be acute, subacute, or chronic, idiopathic or traumatic, simple, specific, or tuberculous.

In a majority of cases active spinal meningitis is traumatic, following wounds and concussions, fractures or luxations of the vertebræ. It sometimes follows exposure to cold, sleeping upon the ground, or remaining long in the water. Cerebro-spinal meningitis, as a specific febrile and inflammatory affection dependent upon a zymotic cause, has already been considered in another connection.

Morbid Anatomy.—The anatomical characters of spinal meningitis are essentially the same as those of cerebral, and their description need not be repeated. The inflammatory products—serous, sanguinolent, fibrinous, corpuscular, or purulent—are mostly between the spinal arachnoid and pia mater. The inflammation often extends to the substance of the cord, constituting meningo-myelitis. In chronic cases the morbid appearances are less marked, and may consist almost exclusively of an increase of the subarachnoid fluid, which may be sanguinolent or opaque; but newly formed connective tissue is sometimes found, causing adhesions of the membranes. In acute cases the inflammation, as a rule, extends over a large part of the membranes or the cord; while in chronic cases it may be limited to a small area.

Symptoms.—The symptoms of spinal meningitis are manifested mostly through the spinal nerves, and may chiefly involve either the anterior or posterior roots, affecting mostly, or almost exclusively, either motion or sensation. Pain is commonly felt in the spine, radiating to the extremities of the nerves in their distribution. Pain is increased by motion and pressure, and there is often hyperæsthesia of the surface. When the anterior roots are involved motor functions are disturbed, there will be tonic and sometimes clonic contractions of the muscles of the extremities and back, and there may be rigidity of the thoracic muscles, causing dyspnœa. As the disease advances, paralysis, generally complete, is likely to follow from pressure upon the cord by the inflammatory exudates; or when inflammation extends to

the substance of the cord its function may be directly impaired or destroyed, producing similar effects. According to the situation of the lesion the paralysis may affect the lower extremities alone or the upper also. Paralysis of motion is much more likely to occur than that of sensation. Indeed, increased sensibility is a common result when motor power is diminished or lost.

More or less fever accompanies the acute cases, and the pulse is sometimes correspondingly excited, though often it is slow, contrasting with the temperature. Profuse perspirations sometimes occur. When the paralysis is incomplete, electrical and reflex excitability usually continue.

Prognosis.—Active spinal meningitis is a grave and very often fatal affection, and not unfrequently runs its course in from one to two weeks. It may destroy life by extending to the medulla oblongata, whose functions are so essential to all life processes, or, short of that, by causing rigidity of the respiratory muscles, and inducing apnœa. When the medulla is involved, dysphagia is a frequent symptom. In comparatively mild and favorable cases recovery may be complete, while in others more or less paralysis or wasting of the affected muscles and tissues may be left behind.

Diagnosis.—This may generally be made without difficulty, especially in traumatic cases. It is more likely to be confounded with hysteria and tetanus than with any other affections, though a case lately under my care manifested general symptoms strongly resembling malarial paroxysm. There were decided chills, paroxysms of fever and profuse sweats, recurring, however, only at intervals of some days. There was much delirium during the fever, and at length dysphagia and death. The inflammation was traumatic, produced by a fall from a wagon when the patient was intoxicated. Paralysis of both upper and lower extremities was produced by the concussion and persisted, while the inflammation which followed completed the work of destruction.

There is more difficulty in distinguishing spinal meningitis from myelitis, and they are very generally combined in the same case. The distinction was referred to when the subject of acute myelitis was considered.

Treatment.—The treatment of spinal meningitis, in principle and detail, will be similar to that of cerebral meningitis. Blood-letting, especially local, may be employed, unless the conditions of the pulse and general system forbid. The danger of effusion is so great that cathartics and diuretics should be given, and mercury internally and by inunction will be advised by those who regard this article as among the most active sorbefacients. Prof. Flint says it is warrantable, if not desirable, used in a manner to induce its speedy constitu-

tional effects. Ergot, belladonna, and bromide of potassium are believed to diminish vascularity within the spinal canal, and are therefore indicated. Iodide of potassium in free doses is indicated, especially when symptoms of effusion present themselves, and blisters may be applied as additional means of promoting absorption. The patient, if possible, should be kept upon his side rather than upon his back, and when paralysis occurs the bladder should be cared for as in other cases.

SPINAL APOPLEXY.

Hemorrhage into the spinal canal is called by this name. The extravasated blood is generally found black and coagulated, though it may be fluid, or partly fluid, mingled with clots. The blood is oftenest effused in the loose connective tissue outside of the dura mater. It may, however, be between the dura mater and arachnoid, or between the latter and the pia mater, or the infiltration of blood may be into the substance of the cord.

Etiology.—The *causes* of spinal apoplexy are various. Apoplexy of the meninges is seldom primary, but dependent upon traumatic injuries, tetanus, eclampsia, epilepsy, chorea, and various circulatory disorders; and meningitis, and inflammation of the substance of the cord commonly precede hemorrhage into its tissue.

Symptoms.—In the majority of cases the symptoms suddenly supervene. They are sometimes confined to those manifested from the spinal cord; but sometimes the shock of the lesion, or an accompanying cerebral congestion implicates the brain functions, and syncope, loss of consciousness, disturbance of speech and of the special senses may be present.

The hemorrhage may be preceded by symptoms of hyperæmia; but often the patient in meningeal hemorrhage is suddenly seized with violent pain, and falls down giving utterance to cries; he is paralyzed in his limbs, and may be in the organs of special sense. Pain in the spine, either local or more general, continues, and there is tetanic stiffness in the muscles supplied by nerves from the part of the cord affected. There are also occasional clonic spasms, and often morbid sensations extend to the more distant parts supplied by the spinal nerves. There are modifications of sensibility of various kinds, but when the hemorrhage and pressure are great, anæsthesia is the result.

The position at which the lesion occurs, whether at the upper or lower part of the cord, will of course vary the symptoms.

Large extravasations high up may result in speedy death; but lower down only in paralysis of the lower limbs.

In favorable cases some improvement soon takes place, but in forty-eight hours, more or less, inflammatory reaction generally occurs, when the symptoms are aggravated. This inflammation may be more or less severe or protracted, but it does not usually disappear before two or three weeks.

In many cases the extravasated blood is absorbed, the symptoms gradually improve, and the functions may all be re-established. When the paralysis is complete the sphincters may be involved, cystitis may be developed, there may be bed-sores, and still more serious results may follow.

Diagnosis and Prognosis.—The diagnosis is made by the suddenness of the attack, the severe pain and rigidity which accompanies it, and by the subsequent course of the case.

In hemorrhage of the meninges the prognosis is favorable if the early danger is passed and some improvement takes place, as the lesion of the cord itself does not usually occur, and the absorption of the blood will lead in time to the restoration of functions.

As hemorrhage within the substance of the cord is generally preceded by inflammation, symptoms of this state, which, however, may be overlooked, will precede the apoplectic attack. When this attack occurs it is sudden, but is not accompanied with as much pain as meningeal hemorrhage. The paralysis, however, is usually more profound, improvement more rarely takes place, and the danger is much greater.

There is in these cases an elevation of temperature in the paralyzed limbs, trophic changes follow, perspiration in the affected part is usually absent, atrophy occurs, and bed-sores are very apt to be developed, the bladder and rectum suffer, and death may take place after a longer or shorter period of suffering.

When the hemorrhage is high up, or the blood is diffused in the central cavity of the cord, death may speedily occur from implication of the respiratory nerves; or if the lesion be less profound, embarrassment of diaphragmatic breathing, dysphagia, etc., may result. When the hemorrhagic point is limited to a lateral half of the cord, paralysis of motion, elevation of temperature, and hyperæsthesia will appear on the same side, with abolition of sensation but preservation of motion on the side opposite to the lesion. According to the extent of the lesion and its location, the course of the disease may be counted by minutes, hours, weeks, or months.

The diagnosis of intramedullary apoplexy is to be determined by the sudden appearance of motor and sensory paraplegia, usually after some premonitory symptoms; by the elevation of temperature in the paralyzed parts (but usually there is an absence of preceding and very

early fever); by the rapid abolition of reflex and electrical excitability of the muscles, and by their early atrophy.

The *Prognosis* is very unfavorable in those cases which are severe in the onset. Hemorrhage in the upper portions of the cord is more unfavorable than in the lower; but if the patient recovers from the first shock and the case takes a chronic course, there will be ground of hope, though the dangers of myelitis and the complications will have to be encountered.

Treatment.—The treatment of Spinal Apoplexy, meningeal or medullary, will consist in perfect quiet and absolute rest; and if the patient be sufficiently robust, and especially if symptoms of cerebral congestion are present, venesection may be demanded. Local abstraction of blood may follow, and cold, by means of ice-bags, should be applied over the affected parts. The diet should be restricted, the bowels kept open, bromide of potassium and ergot may be resorted to, and anodynes may be given should the pain be excessive. Later in the disease attempts should be made to prevent effusion and promote absorption, by the use of iodide of potassium and perhaps other sorbefacients. As in other cases of paraplegia, the bladder and rectum should receive proper attention. The continuous warm bath, as a means of preventing bed-sores, is worthy of a trial, where the occurrence of such sores seems inevitable without its use. That a person may remain weeks and months in tepid water without serious, or even unpleasant consequences, has been sufficiently demonstrated. As elsewhere stated, arrangements must be made for keeping up the proper temperature by admitting a small stream of warm water at one point while the same amount flows out at another. The bath-tub, excepting at the head, should be covered with an impervious rubber sheet to prevent evaporation, and that by non-conducting blankets to prevent the radiation of heat. The head is to be supported on a hair pillow, properly sustained, and the body being buoyed up by the water, there is no undue pressure upon any one point, and thus bed-sores are prevented. Persistent paralysis in the limbs, as in other cases, may require frictions, passive motions, electricity, etc., as means of keeping up nutrition, so that in case the central lesion is repaired the muscles will be in a condition to respond to the proper nervous influence.

INTRAMENINGEAL OR INTRAMEDULLARY TUMORS, AND NEOPLASTIC GROWTHS OF THE SPINAL CORD.

These growths of the cord, as of the brain, may take place, pro-

ducing compression of the cord and other pathological conditions, and a variety of symptoms.

Sarcomatous and allied tumors are the most frequent of those belonging to the spinal *meninges*.

As the physiological functions of different tracts and portions of the cord differ, the symptoms will be varied. The medulla oblongata being a continuation of the cord may be considered as a part of it, and tumors occurring in that important part produce peculiar symptoms. Labio-glosso-pharyngeal paralysis, and other symptoms similar to these which result from a slow inflammation and sclerosis of the medulla, may be produced by tumors, and these affections are quite as intractable and perhaps shorter in their course.

Besides the bulbar symptoms produced by tumors in this situation, compression of the medulla may give rise to *Cheyne-Stokes* respiration and modifications of the urine. These vary as the lesion affects one or another of the centres of vascular innervation of the cord. Not unfrequently albuminuria is present where a tumor compresses the medulla oblongata, and diabetes may occur when the fourth ventricle is involved in the irritation or compression. It seems to have been shown in Bernard's experiments producing diabetes that he irritated the centre of the vascular nerves of the liver, thus modifying its circulation and nutrition, and consequently its function in the production of sugar. In other cases simple hydruria is produced, and then it is supposed that the centre of the vascular innervation of the kidneys is affected.

Lower in the cord, according as one side or both, the anterior, the posterior, the lateral, one or all are compressed, the symptoms will vary. In unilateral compression, spinal hemiplegia may occur, or when the compression is lower down, hemiparaplegia, with alternate hemianæsthesia may be developed. Symptoms will be produced similar to those of compression of the cord from other causes, paralysis of one kind or another being the common result.

Diagnosis.—This is to be made by excluding disease of the vertebræ and pressure from deformity, and also inflammation, thickening, and effusions of the membranes.

Then the radiating pain, the progressive increase of the paralysis, the increasing muscular atrophy as the cord softens, is more pressed upon or destroyed, and the abolition of electrical excitability of the muscles and nerve trunks will make it probable that there are intrameningeal tumors.

Tumors may also develop in the *parenchyma* of the cord; the symptoms produced are then somewhat dissimilar. There is a comparative absence of pain when the tumor is developed in the sub-

stance of the cord, distinguishing it from meningeal tumors where the pain is great, and there are apt to be increased reflex excitability and spontaneous convulsions in the parenchymatous tumors.

There are, however, exceptions to these conditions, and the differential diagnosis is uncertain.

Prognosis.—The prognosis is unfavorable, so far as a cure of the paralysis is concerned, but life may be prolonged by proper care in the management of the paralysis. No radical treatment will be of use, and the management of the paralysis is referred to in the account of other conditions.

Compression of the spinal cord, from disease of the vertebræ, (Pott's disease) is a surgical rather than a medical affection, and the reader is referred to the works on surgery, and especially to orthopædic works, for its discussion.

Hygienic and medicinal measures are often required, but mechanical treatment is essential to the best success, and the plaster cast, with the suspension process, which Dr. Sayre has been most active in bringing to the notice of the profession, has justly received very general approval. The extent of its advantages has not been entirely settled.

SPINAL IRRITATION.

For the last half century or more a peculiar morbid condition, most distinctly marked by tenderness on pressure or percussion over certain points along the spinal column, has been observed, to which the name of *Spinal Irritation* has been applied. It is a very frequent condition in debilitated and nervous women, and is generally associated with derangements of the abdominal or pelvic viscera.

Symptoms.—There are three points in the spine more subject to this tenderness than others. One, the most common, is in the region of the seventh or eighth dorsal vertebra, between the shoulders; another, next in frequency, is at the lower part of the cervical region, and the third is in the upper part of the lumbar region. In perhaps a majority of cases all three of these points are tender—that between the shoulders most so. There are different degrees of this tenderness in different cases; and occasionally the whole extent of the spine is exceedingly sensitive, even to a slight pressure.

In decided cases not only is pain given which may last for some time at the point of pressure, but darting pains will extend around the body, and a sense of faintness and depression will be felt at the epigastrium, especially when the point between the shoulders is pressed upon. Sometimes by such pressure a cough or dyspnœa is induced,

nausea may be excited, and the heart's action may be rendered rapid and irregular.

Such patients are peculiarly subject to neuralgic pains in different parts of the body, to headaches, restlessness, and a long train of symptoms generally designated as "nervous." In many cases (according to my observation in most) some abnormality, functional or organic, of the pelvic organs will be found—ovarian or uterine hyperæsthesia, uterine displacements, endometritis, uterine congestion, leucorrhœa, etc., are present; or some abnormality of the sexual feelings, or excess of indulgence may be discovered.

In other cases there are marked dyspeptic symptoms, with deranged action of the liver, and constipation of the bowels. The urine will vary much in amount at different times, and will not unfrequently contain oxalate of lime.

A decidedly hysterical state is not unfrequently, though by no means always, present; and when these conditions are long continued, great debility and more or less anæmia are likely to result.

Sometimes the pain and tenderness of the spine will be spontaneously complained of, but at others the patient will not have known that such tenderness existed until pressure on the points is made in the examination of the case.

Pathology.—The pathology of this affection has given rise to discussion, and in the present state of our knowledge it must be regarded as obscure and uncertain. The tenderness seems to consist, in part at least, in hyperæsthesia of the integument over the spinous processes, though pressure over the emerging nerves is deeply felt, and pain is often produced by the pressure in their course and at their terminations.

Dr. Hammond is positive in expressing the opinion that *anæmia* of the posterior columns of the spinal cord is the essential pathological condition; and though no anatomical demonstration of this view is afforded, an attempt is made to sustain it by analogies and inferential reasoning, which, however, must be regarded as inconclusive.

The most that can be said is, that irritation exists and affects the sensory more than the motor columns of the cord. The cause of that irritation is not determined. Dr. Hammond's reasons for considering it anæmia are, that irritation is often a result of a deficient supply or a poor quality of blood; that the diagnosis of other diseases of the cord has generally improved, and that the phenomena of this affection do not correspond with the other recognized diseases; that those agents that diminish the quantity of blood in the cord increase the symptoms in spinal irritation; and that the general condition of the patients affected with it is below par.

It is true that irritation often exists in parts scantily supplied with blood, but this is by no means always the case. Anæmic parts are often simply depressed in action, and irritation is produced by many other causes. That blood of bad quality produces irritation does not prove that deficiency of blood must do the same. A want of correspondence between the symptoms of spinal irritation and other well recognized forms of spinal disease does not prove that the pathological cause of this is anæmia. And if it be granted that the agents which diminish the quantity of blood in the cord increase the symptoms, such results may be from other qualities of such agents rather than from their mere power of diminishing the blood. And finally, it is not true that all persons with spinal irritation are "below par" in the amount or richness of their blood. I have not unfrequently seen females well nourished, and some positively plethoric, who had marked tenderness of these points along the spine with other corresponding symptoms, and who were relieved by far other measures than those which are supposed to have the effect of increasing the spinal blood.

Not long since, a stout, robust young woman, recently from Massachusetts, applied to me for what her physicians had pronounced "spinal anæmia," and for which she had been treated with quinine, iron, strychnine, and other tonics without relief. The three points in the spine were tender; she was a student, but unable to apply herself closely to her studies, and in many ways was in a wretched state. Her appetite, however, and her nutrition were good. On investigation there was found to be retroversion of the uterus, with congestion of the organ. She was advised to take saline cathartics, and bromide of potassium, and to use hot water vaginal injections; and soon a closed Hodge's pessary was introduced. Marked improvement was speedy, and in a few months recovery had taken place. From long observation upon the subject it has appeared to me that, in a majority of cases at least, spinal irritation is a secondary affection, depending upon disease of the pelvic or abdominal viscera, the "irritation" being produced by morbid impressions conveyed from these organs to the sensory cord, and that the mere quantity of blood in the cord has little to do in the production of the effects.

For years past I have ceased to apply any irritating local remedies to the spine, have tried to direct the attention of patients from it, have endeavored to remove the peripheral pathological conditions which I believed to be the cause, and to improve the general health. In very many cases tonics are required, as debility is present; and the removal of debility tends to diminish sympathetic irritation.

Diagnosis.—This is to be made by observing the symptoms which constitute its phenomena. Its existence as a primary, inde-

pendent disease may be doubted. When this irritation, however, is present, it produces reflex symptoms in various parts, and its removal may be an object of importance.

Treatment.—With this view of the pathology of the disease, the indications of treatment are to remove the primary disease upon which the symptoms depend, to soothe the irritation, and to improve the general state of the system. As the disease is much more frequent in women than in men, and is so often dependent upon uterine and ovarian derangements, these should be carefully inquired into and corrected by appropriate measures. The conditions of the stomach, bowels, liver, and kidneys must also receive attention and correction according to their state. The fulfilling of those objects will constitute the most important part of the treatment.

Various nerve tonics and soothing measures may be indicated. To diminish sympathetic and reflex irritability opiates are of great temporary benefit, but the establishment of the opium habit must be carefully avoided. Alcoholics will often produce temporary relief, but the alcoholic habit is still more to be dreaded. These remedies must therefore be used with reserve, must be kept in the hands of the physician, and must not be long continued. They are only temporary in their effects. The same may be said of chloral hydrate and other narcotics. Anodyne liniments and plasters will sometimes procure relief, and some still advise counter-irritation. The thermal bath, or water as warm as can be borne, will sometimes procure temporary relief; but the severer forms of counter-irritation, such as large blisters, severe cupping, croton-oil, and tartar-emetic pustulation, should not be used.

The nerve tonics, such as the preparation of zinc, of silver, of phosphorus, and nux vomica may be of use; and iron, quinine, and cod-liver oil are often applicable. The direct galvanic current has its advocates. Hammond advises, in these cases, to apply the negative pole above, the reverse of what, according to the same authority, should be the practice in congestion, the current being sent upward. But this remedy, here as elsewhere, should be used with caution, should be applied gently and for a short time only at first, and its effects carefully observed.

FUNCTIONAL PARESIS.—REFLEX PARAPLEGIA.

The *Anterior and Lateral Columns of the Cord* are subject to "irritation," perhaps to spasm of the vessels and anæmia, and to the failure of power, producing motor changes, particularly in the lower

limbs. A loss of power in these limbs, generally incomplete, has received various names, as functional paralysis, reflex paralysis, inhibitory paralysis, or paralysis from peripheral irritation.

In this form of paralysis, mostly confined to the lower extremities, the patient is usually able to walk, though with difficulty, and some muscles are more likely to suffer than others. Slight spasmodic contractions sometimes occur.

The paralysis usually comes on suddenly, is generally as severe at first as subsequently, does not extend, as in that from congestion or inflammation or degenerative processes, and the bladder and rectum are but rarely involved. The electro-muscular irritability is not changed, and reflex excitability is generally unaffected.

Sensibility is seldom much affected, and pain in the limbs is rare.

Anæmia of the cord and loss of power may result from pressure upon it, or from obstruction in, or obliteration of, the arteries supplying the part. Exposure to extreme cold, or remaining for a long time in cold water, may produce the effect, or it may be the result of severe and exhausting disease. But by far the most common cause of the forms of paralysis now under consideration is *Peripheral Irritation*, and often of the urino-genital organs. It has sometimes been called urinary paralysis, though worms in the intestines, and other peripheral irritations, may act as the cause. Whether the explanation given by Dr. Brown-Séquard and others, that reflex irritation causes spasms of vessels and consequent anæmia, be the true one, may be questioned; and some doubt whether the effect is produced by reflex action. It is believed by Weir, Mitchell, and others, that neuritis, extending from the urinary organs to the cord, and causing changes in its structure, is the real condition. Whether this form of paralysis arises from inflammation extending along the nerves, or from reflex action, its connection with irritation of the urinary organs has been observed too often to be considered a mere coincidence, and a causal relation must be regarded as existing.

Diagnosis.—Whatever may be the pathology, this form of paralysis is distinguished from that produced by congestion of the cord by the fact that the symptoms are mitigated by the dorsal decubitus and by the use of spinal stimulants, and by the further facts that this paralysis is so often preceded by urinary diseases, does not tend to increase, and usually disappears when the urinary disease or other irritating and exhausting affections are removed.

Prognosis.—This is favorable when the paralysis depends upon removable diseases of the urinary organs, but when dependent upon obstruction or obliteration of the vessels supplying the cord, it may

not be so. When it is produced by dysentery, fevers, etc., restoration, after a time, usually takes place when the debility is overcome.

Treatment.—While the pathology of this form of paralysis is in question, the principles of treatment may be in more or less doubt. There can, however, be no question about the necessity of giving attention to any disease of the urinary organs which may be present, and of removing all peripheral irritations or other causes that may be appreciable. When this is accomplished, and sometimes before, a general tonic course is indicated, and strychnine, electricity, quinine, iron, etc., will usually be called for.

When there is reason to suspect any structural change going on in the cord or nerves, the iodide of potassium should be prescribed.

When the affection is dependent upon obliteration of the arteries, no treatment will be likely to be availing. The correction of all injurious habits, and proper general hygienic management, will be important.

LOCALIZED SCLEROSIS OF THE SPINAL CORD.

Besides the disseminated or more general sclerosis which has been described in connection with sclerosis of the brain, more localized changes of a similar character take place, or sclerotic degenerations are confined to particular tracts of the cord, giving rise to peculiar forms of disease.

LOCOMOTOR ATAXIA.

Locomotor ataxia is one of these special forms of disease.

This affection was formerly designated as *Tabes Dorsalis*, and is still treated of by some under that name.

Since the investigations of Bouillaud, of Todd, and others, and especially of Duchenne, locomotor ataxia is known to consist chiefly of a defect of coördination of movements, and to be dependent upon sclerosis and wasting of the *posterior columns* of the spinal cord.

Morbid Anatomy.—The pathological changes of this disease have been the subject of careful study, and the discoveries made have caused the names of *Gray Degeneration of the posterior columns*, *Sclerosis of the posterior columns*, *Posterior Chronic Leuco-myelitis*, to be applied. The morbid changes, however, are not in all cases confined to the posterior columns, as a part of the lateral columns and the gray substance are not unfrequently involved.

On a section of the cord the posterior columns are found of a grayish color, very much diminished in size, and of a firm (though

very rarely of a soft) consistence. When the disease involves chiefly the lower limbs, which is generally the case, this lesion is found in the lumbar region. If the seat of the disease is in the upper extremities the lesion will be in the cervical region, and may, in some cases, be traced into the medulla oblongata, the restiform bodies, the gray substance of the floor of the fourth ventricle, into the pons Varolii, and even into the cerebral ganglia. The median portion of the posterior columns is the seat of a secondary degeneration, which proceeds from below upward. In occasional cases degenerative processes extend to other parts of the cord, inducing complications. Thus progressive muscular atrophy may occur in connection with ataxia, produced by extension of the morbid change in the net-work of nerve fibres which are thought to connect the internal root fibres with the gray matter of the interior.

Examined microscopically the nerve fibres are found changed into a substance strewn with fine granulations and fatty molecules, or are replaced by the material of connective tissue.

Accumulations of fat and pigment are often seen in the vessels, and there are sometimes nuclear proliferations. Varicose capillaries with thickened walls, and amyloid corpuscles and granules are found in the degenerated substance. The nerve cells of the posterior horns have been found partially affected by sclerosis. The *posterior horn roots* are thin and hard, having undergone fibrous degeneration. The sciatic, crural, and brachial nerves are sometimes changed in a similar manner, and several cranial nerves, especially the optic, motor-oculi, and hypoglossus, are sometimes degenerated and atrophied. In addition to these changes the membranes of the cord are often, but not always, thickened and adherent to the posterior column.

According to the latest researches, lesions of the *postero-external columns* are sufficient to produce ataxia; but in advanced cases the degenerations involve the median columns also. Not only this, but the sclerosis may extend to the posterior horns, and sometimes to the posterior part of the lateral columns; and, as already stated, secondary lesions may extend to still other parts.

Etiology.—As to the causes of locomotor ataxia, differences of opinion exist. By some it has been attributed chiefly to abuse of the sexual system—to premature, unnatural, or excessive venereal indulgences. Others regard this as exceptional, and believe that when excesses occur they should, often at least, be considered as the effect of the irritation of the earlier stages rather than the cause of the disease. That sexual excesses tend to produce disease of the spinal cord and loss of power, there can be no doubt; but whether this particular form of posterior spinal sclerosis is thus produced is not so clear. The fre-

quency, however, of a history of masturbation, or of long-continued sexual excesses in these cases, is more than a coincidence; and the long time such excesses have occurred previous to the symptoms indicating the disease, has seemed to show that the excesses were the cause rather than the effect of the morbid state.

It is generally admitted that masturbation, involuntary seminal losses, and excessive coitus constitute an important factor in the causation of this disease.

Exposure to cold, working in water, and exhausting labor are also important factors; and when the two classes of causes are combined, the result is most likely to follow. Age and sex also exert an influence upon causation. It is most common between thirty and fifty years of age; though a young man of about twenty was very recently under my care in an advanced stage of the disease, with extreme ataxia, the symptoms having commenced soon after puberty. Masturbation was practiced in this case, and involuntary seminal losses continued two or three times a week up to the period of his coming under my observation. Under the use of bromide of potassium the seminal emissions were greatly diminished in frequency, and this treatment, combined with the use of electricity, seemed to produce some improvement for a time in the ataxia; but his general health did not improve, and he left the hospital without material change.

Men are much more subject to the disease than women, and family peculiarity sometimes exerts an influence upon its occurrence.

It has been observed to follow or to be associated with other affections, and syphilis, rheumatism, pellagra, hysteria, and epilepsy are among those which have been named. A man of forty-five is now under my care with locomotor ataxia, who has had repeated attacks of syphilis, is entirely blind from atrophy of the retina, and as a miner has been exposed to the fumes of mercury for long periods.

Erb has lately reported thirty-three cases, in which a history of syphilis existed in twenty-nine.* In most of Erb's cases, as well as in the one above referred to, the syphilis was in a mild form, and preceded the ataxia by some years. It should be stated that in many cases no particular cause for the affection can be assigned.

* Since the above was written he has reported a still larger number, with about the same proportion of syphilis. In my own experience a history of syphilis has been found only in a *small minority* of cases. It is a question whether the frequent occurrence of syphilis in large cities and among those who supply the hospitals and out-patient departments, does not render the affections coincident rather than prove a special relation between them. In rural communities, where syphilis is rare, locomotor ataxia not unfrequently occurs; and I am sure that in the rural districts of this country it is comparatively seldom associated with syphilis.

Symptoms, Course, and Diagnosis.—When fully developed, locomotor ataxia presents well-marked symptoms. It is not a simple paralysis, as the absolute muscular power is often unimpaired. Its essential feature is incoördination of muscular movements, almost constantly commencing in the lower extremities, gradually increasing in degree and extent, and frequently in time involving the upper extremities and other parts. The ataxic invasion is generally gradual and preceded by other symptoms, especially darting pains, but sometimes it is more abrupt; and it consists at first in a peculiar, awkward, clumsy gait, with an uncertainty in the movements, which is increased to an inability to control the action of the limbs so as to walk in the dark or with the eyes closed. There is difficulty in maintaining the equilibrium, which is greatly increased when not aided by the sight. One of the earliest symptoms clearly indicative of the disease is the inability to stand with the feet together, when the patient is blindfolded or his eyes are closed. At once he begins to totter and sway, and unless he opens his eyes or is supported by others, he falls to the ground. This may occur in some other affections, but it is quite constant in ataxia.

As the disease advances the movements become more tumultuous and peculiar; and when attempting to rise from his seat his legs jerk about, and he is obliged to aid himself by his hands upon his chair or by a stick in assuming the erect position. After getting upon his feet he balances himself for a time, and then starts off with his body bent forward and his legs apart, lifting his feet with unnecessary force and bringing them down with a slap. The leg on which he rests while the other is awkwardly raised is unsteady, thus rendering the gait peculiar and characteristic. At length there is a necessity for a stick in walking, and, in advanced cases, the patient must sometimes have a long stick, which he grasps in both hands to aid him in keeping upon his feet and in getting about. In time this resource fails, and he is either confined to his chair or is assisted by others.

During all this time the real strength of his muscles, as tested by extension or flexion of his legs may be normal, and he is not easily fatigued. The time, however, usually comes when power begins to fail, and the exertion in walking is such that exhaustion soon follows. Even after the patient is confined to his chair or bed the muscles generally retain their bulk, their tonicity, and their electrical contractility, and for a long time they may retain their absolute strength. Paralysis, both of motion and sensation, however, sometimes occur; but they may be regarded as complications rather than the proper phenomena of the disease.

At an early period of the ataxia, and throughout, more or less

numbness and tingling are felt, often increasing, and always from below upward. Cutaneous sensibility of the feet is generally materially impaired. This gives the patient the impression that they are soft or swollen, or that they are wrapped in some soft covering; or in walking he feels as if he was stepping on sponge or wool. Sensibility to tickling often disappears first, common tactile sensibility later; while sensibility to pain rarely disappears, but is perverted; and often when lying down with his eyes closed, the patient is unable to tell the position of his limbs. The affected parts, however, are generally sensible to the impressions of heat and cold to the last, but sometimes even this is altered at a late period. Often there is a delay of sensory impressions (apparently from obstacles to transmission in the gray substance of the cord), which may amount to two or three seconds. (Rosenthal.)

In most cases, sooner or later, symptoms of the disease appear in the upper extremities. Numbness or tingling begins in the fingers, and may extend to the hands and arms, but continues most in the part first attacked. Clumsiness of manipulations follows; a pin upon a hard smooth surface cannot be picked up; he cannot place his fingers with accuracy upon a particular part of his face, and, in short, the upper extremities become affected similarly to the lower.

Unlike the conditions in severe or advanced paraplegia, the patient retains control of the rectum and bladder, and seldom has bed-sores.

In some cases the muscles of the head and trunk become similarly affected. There may be difficulty of articulation from irregular action of the muscles of the mouth and tongue; paralysis of various cerebral nerves may supervene; there may be double vision or loss of sight, or loss of hearing; pain in the head may become severe; and when the disease extends to other than the posterior columns of the cord, and to various parts of the brain, other symptoms than those of ataxia—paralysis, wasting of muscles, more perfect loss of sensibility, etc.—may supervene.

Though commonly symmetrical, it may be confined, for a time at least, to one limb, and not unfrequently the two limbs are unequally affected.

Occasional cases occur in which the progress of the disease is rapid, and the patient is bedridden in a few months, but much more commonly the progress is slow, and some years elapse—ten, twenty, and even thirty—before the termination of the case. The course is so commonly progressive as to have caused Duchenne to call the disease *locomotor ataxia progressiva*; but some cases remain stationary for long periods, and others actually improve, though complete re-

covery very rarely if ever occurs. The sense of taste may be changed, vaso-motor and trophic disturbances sometimes take place, the joints may become affected, the upper extremity of the humerus especially may become atrophied; and as remote complications *dementia paralytica*, melancholia, and *muscular atrophy* may result.

The causes of death are various, but generally it is due to some intercurrent disease; but it may be due to implication of the muscles of respiration or deglutition, or to the extension of the disease to other parts.

As a means of distinguishing locomotor ataxia, the absence of what is called the "patellar tendon-reflex," or what may be more simply called the "knee-jerk," has of late been made much of. It is well known that in the normal state, when the knee is flexed so that the quadriceps femoris is gently extended, and the leg is free to move, a blow struck with some little force upon the patellar tendon causes the quadriceps to contract and jerk the leg forward.

The most convenient position for obtaining this effect is to have one knee placed over the other, the under one at a right angle and the upper one flexed nearly, but not quite, to the same degree. If the leg is very large, the effect is more readily obtained by placing the arm of the observer under the thigh, a little above the knee, and raising the part, when the blow may be struck upon the tendon, as in the crossed-leg position. The blow may be struck by the side of the extended hand, or by the back of a thin book, or, better, by a stethoscope with an India-rubber ring about the grooved ear-piece, such as I have long used in making percussions in examining the chest. It is not usually necessary to make the part bare for this test, but in doubtful cases it is better to do so. Dr. Gowers, of London, objects to the term "tendon-reflex," as he says the effect is dependent on a muscle-reflex—the blow upon the tendon acting through the patella and producing a sudden tension of the muscle which causes it to contract—and he suggests the expression "tendon-muscular phenomena," or "myotatic contractions." The irritability on which this muscular contraction depends is due to, and is an evidence of, a muscle-reflex action which depends on the spinal cord. (Diagnosis of Dis. S. Cord.)

In some morbid conditions of the cord, as in lesions high up which cause degeneration in the lateral columns (the pyramidal tract), these reflex contractions are in excess, and in some healthy persons they are much more active than in others; but in ataxia these contractions are usually diminished or lost.

Coördinations of movements probably have their seat in the basal ganglia of the brain, but are communicated through the postero-external column of the cord, or the zone through which the posterior

nerve roots pass ; and by muscular reflex actions muscular contractions become associated. If these statements be correct, we can readily see how a loss of the muscular reflex action should be associated with, and an evidence of ataxia; and we can also see that both of these conditions should be produced by a lesion of the same part.

Whatever the explanation, the fact is that in locomotor ataxia the reflex action normally produced by striking on the patellar tendon is almost always impaired, and is commonly lost, at an early stage of the disease. There are cases, however, where ataxia exists, but where the "knee-jerk" is not lost. A case of this kind, where all the other evidences of ataxia were present, but where the "knee-jerk" was active, was lately seen. A man about forty-five, in otherwise fair health, had suffered from the "lightning pains" in the legs, with the slowly approaching ataxia, etc., yet had the "knee-jerk" quite as marked as normal. "In these cases there is probably sclerosis of the lateral columns, as well as of the posterior. The former will tend to increase the muscle-reflex action, and apparently the damage to the posterior roots is then insufficient to arrest it, although it may perhaps interfere with the connection between different groups of nerve cells." (Gowers.)

Other complications will vary the phenomena in locomotor ataxia, and render the early diagnosis of some cases obscure ; but when the positive muscular power is retained, though with inability to regulate motions and maintain equilibrium without the aid of sight, etc., the diagnosis of ataxia should be made.

When the full development of the disease as described occurs, the *diagnosis* cannot be difficult. It is desirable, however, to distinguish it at an early period, before the *ataxic* symptoms come on, and the premonitory symptoms should therefore be carefully studied. These are produced by vasenlar or inflammatory irritation of the cord, and especially of the nerve roots and their prolongation into the gray substance, and consist of *shooting pains in the limbs*, which follow one another more or less rapidly, and these pains are usually accompanied by chills, acceleration of pulse, and cutaneous hyperæsthesia. Sometimes there are deep-seated girdling pains around the trunk. These intermitting neuralgic pains are generally, though not always, present, and they yield but imperfectly to treatment. They may be experienced in different parts of the body, especially in branches of the cervical or brachial plexus, and there is often numbness of the hands, fingers, and toes. There may be cardiac palpitation and syncope in rarer cases ; and when irritation extends to higher parts, cerebral congestion, manifested by a sense of fullness, compression, or constriction, with or without notable elevation of temperature, may be observed.

The spinous and transverse processes, and the skin and muscles covering them are usually sensitive to pressure. The nerves extending to the lower extremities are often painful and tender, and pressure upon the feet or hands, as by a tight-fitting shoe or glove, may become insupportable.

Pains referable to the viscera sometimes occur, such as pain in the bladder with a frequent desire to micturate, pain in the urethra produced by the passage of urine, pain in the rectum with a sense of distention or tenesmus. Quite important among these are attacks of gastralgia of great intensity, the pain frequently shooting to other parts, and often attended with vomiting, deranged action of the heart, and a severe sense of illness.

These symptoms are not always present—the severer ones are frequently absent—and those of a similar character occur in other affections; but when present, they are suspicious of approaching ataxia, and should receive prompt attention.

At this early period of inflammatory irritation, and before the profounder structural changes occur in the cord, treatment may possibly be efficient in preventing such changes and the full development of the disease. Hence the importance of their careful early observance. Many diseases, incurable after their full development, may be arrested by timely treatment, and attention to diseases in their incipency is not sufficiently insisted upon, nor directions for their management given, in most of the systematic works. In fact, in hospital and consultation practice diseases are very seldom seen in their incipency, and those who have had only such practice (as is the case with perhaps all of our foreign authors) can hardly be regarded as authorities respecting the effects of treatment in the earliest stages of such diseases.

Treatment.—When locomotor ataxia is fully developed, remedies have very little effect upon its progress. At any rate they do not remove the disease. Bristowe says: “When temporary improvement has occurred under our observation, it has always seemed due simply to avoidance of overexertion, to rest, protection from cold and wet and other such adverse influences, judicious dieting and good hours; in fact, to careful attention to the general well-being of the bodily health.”

No doubt such management is of primary importance in all cases of this affection and in all its stages. In the premonitory or early stage of the disease, when inflammatory irritation is the pathological state, treatment designed to remove that condition may be of much use. As in other cases of spinal or cerebral hyperæmia, bromide and iodide of potassium, ergot, and belladonna, would be suggested. These remedies, selected according to the particular conditions, com-

bined with proper hygienic management, the avoidance of all the causes, and the proper use of laxatives, and perhaps counter-irritation, may be of essential service. They are at least worthy of a persevering trial in the early stage. When the ataxia is present, the degenerative lesions are presumed to have taken place, and it is believed that they cannot be repaired. Still, in these more advanced conditions Brown-Séquard and Duchenne advise the use of iodide of potassium, but Rosenthal says he has obtained from it no appreciable effects.

Nitrate of silver has been advised by a greater number of distinguished authors than any other remedy. It may be prescribed in pills with some extract, in the usual free doses of this article, and if irritation of the stomach is induced it must be suspended, and smaller doses after a time resumed. The phosphide of silver is sometimes used in its stead, but the effects of the two preparations are much the same, and in a majority of cases they both fail to produce any marked benefit.

Ergot and belladonna are strongly advised by Brown-Séquard, and may be tried where evidences of hyperæmia of the cord are present.

Bromide of potassium is most useful where increased reflex excitability exists, where there are nervous agitation, neuralgic pains, spasmodic actions, and especially when there is sexual excitement. From thirty to fifty grains daily may be given. It is usually well borne, and may often be continued indefinitely; but where it produces irritation of the pharynx, coryza, diuresis, diarrhœa, or weakness of the muscles, it must be suspended for a time at least, and resumed with proper care.

Phosphorus has been advised, but experience has not established its efficacy, and it often deranges digestion.

Arsenic, the chloride of barium, and various other remedies have been recommended or suggested, but have failed, in the hands of most who have tried them, to produce any marked or permanently good effects.

When the ataxic pains are great, relief is obtained by opiates, best given by hypodermic injections of morphine, or morphine and atropine, and by hydropathic measures, or the methodical use of electricity. Chloral hydrate and other anodynes and soporifics will be temporarily useful when there is much suffering or insomnia.

Stretching the sciatic nerve has lately been tried for the relief of the pains connected with locomotor ataxia, and with the alleged effect of not only relieving the pain, but of diminishing the ataxia also. The cases in which this have been tried has not been sufficient to fully establish its value. Dr. Brown-Séquard's experiments have shown that impressions upon nerves modify, often markedly, the condition

of nerve-centres, and it may be found that nerve stretching in this disease is a valuable resource. In a disease so little under the control of the remedies heretofore used, a trial of doubtful expedients may be justified.

Bleeding and hot baths, from their debilitating effects, are contra-indicated; but, according to Rosenthal, hydrotherapeutical measures constitute the most efficient means of treatment in this disease. "By methodically stimulating the vast expanse of sensory nerves, and by rendering the peripheral circulation and the cutaneous functions more active, hydropathic treatment allays the central irritation, strengthens the nervous system, and diminishes its great excitability and the dangers to which it is exposed on account of its sensibility to atmospheric changes."

Everything, however, depends upon its cautious and proper use. Rosenthal advises frictions with a cloth dipped in water of a temperature of from 18° to 15° C. (64° to 60° F.), while at the same time a cold compress is applied to the head, and the patient is then placed in a bath of 24° to 20° C. (76° to 68° F.), into which cold water is slowly poured until the temperature is lowered to 18° or 16° C. (64° to 61° F.). The patient remains in the bath from four to eight minutes, is then showered, and friction is applied to the back.

This process, when useful, will cause a sense of comfort, and after the patient is thoroughly dried he may take moderate exercise in the open air. It is thought that very cold water, strong affusions to the head, douches, and wet packs, produce too exciting effects upon impressionable patients. Improvement of the general condition by the long-continued judicious use of the hydropathic method is said to be frequent.

Most of those who have had much experience in the use of electricity testify to its utility in this affection. In the earlier stages it must be used very gently—the constant current with moderate tension, through the vertebral column, and for a few minutes only, will be borne. When there is much excitement and sensitiveness even this may cause irritation. In the advanced stages the faradic current is less useful than the galvanic, and in every stage the production of violent and painful contractions must be avoided. In sluggish cases with slow progress, electricity may favorably affect the sensory disturbances, and when the muscular power rapidly fails the prudent application of the constant current may increase the motor functions, though these measures do not apparently arrest the progress of the disease. The continued use of electricity, and the hydropathic method, cautiously and skillfully applied, perhaps furnish more prospect of relief than any other measures. It should, however, be borne in mind

that these are powerful agents, capable of doing harm as well as good, and must not be entrusted to ignorant or careless hands.

LATERAL SPINAL SCLEROSIS.

The lateral portions of the spinal cord are subject to pathological changes similar to those described as occurring in the posterior columns, but, from the different functions of these parts, different symptomatic phenomena are presented.

A *Primary Sclerosis* of these columns, it has lately been shown, may take place. The *Anatomical* characters of this affection so nearly resemble those of the posterior columns as to require no particular separate description. In this *Primary* form of the disease the lesion affects by preference the posterior segment of the lateral columns, and extends upward from the inferior portion of the cord, often into the pyramids and pons Varolii, and may in some cases be traced into the pes pedunculi. *Secondary Sclerosis* of these columns may also occur, and when arising from a single focus, it is said to involve the opposite column and to be limited in longitudinal extent. Several observations by Chareot and others have been made, but more are required for a full elucidation of this subject.

Symptoms.—The disease is said to commence with slight evidences of paresis in the lower limbs, and walking or prolonged standing becomes difficult. Later, stiffness and want of suppleness develop in the legs, with involuntary tonic movements, which continue a short time, and are manifested chiefly in the knees. (Rosenthal.) These tensions are not very painful; the patient takes short steps, the legs are close together and drag upon the ground. When the eyes are closed there is not the inability to preserve the equilibrium as in ataxia. The nutrition of the muscles is preserved, and their electrical excitability remains even after the disease has continued for several years, though in the last stages some wasting and relaxation usually occur. Sensibility is normal, cutaneous excitability and muscle reflexes are generally exaggerated; the functions of the brain and cranial nerves, those of the genital and urinary organs and of the rectum, remain intact, and bed-sores do not form whatever the condition of the disease.

At a more advanced period the lower limbs become *permanently rigid* and affected with immobile contractions, the rigidity being subject to paroxysmal increase, attended with severe pain. The contractions are mostly in the extensor muscles and in the abductors, so that the legs are usually fixed in forced extension, the feet in equino-valgus,

and the knees firmly pressed together. The muscles of the back and abdomen are sometimes involved in paresis and rigidity; and in exceptional cases, and usually after very long continuance of the disease, the arms are contracted firmly against the trunk. Generally but slight stiffness of the arms is observed.

Prognosis.—Primary lateral sclerosis usually continues for a number of years, and when death occurs it is from intercurrent affections; but some cases recover, even after its highest stage of development has taken place. Partial recovery is not infrequent.

Diagnosis.—This affection has not long been distinguished from chronic myelitis, and indeed the first stages are probably slowly inflammatory in their character; and further observations are required for a fuller understanding of the subject. But in ordinary chronic myelitis, other symptoms than those detailed are produced, as other than the lateral columns of cord are involved.

Chareot has distinguished a modified form of symmetrical paraplegia, which he calls *amyotrophic lateral sclerosis*, consisting in a primary sclerosis of the lateral columns, with a corresponding change in the anterior gray horns. Symptomatically it is a continuation of the preceding phenomena to which are added those of progressive muscular atrophy.

In this form of disease the upper limbs are first involved in paralysis, atrophy, and fibrillar spasms, with the retention of electrical contractility. It usually remains stationary for several months, and then involves the lower limbs in motor paralysis, but without affecting the bladder or rectum, or inducing bed-sores. After another period a third stage occurs, in which the preceding symptoms are exaggerated and symptoms of *sensory paralysis* are added. All these stages usually appear in from six months to a year, and death occurs in from two to three years from the beginning.

Treatment.—The treatment of these forms of disease is the same as that for the other forms of spinal sclerosis already described, and need not be repeated in detail. Electricity and hydrotherapies are chiefly relied upon by Chareot and others; but in the early stages other means, as pointed out in the preceding affections, are worthy of a trial. In the advanced forms of the disease no treatment has been found successful. So far as known the cases have been uniformly fatal.

A *Spasmodic Spinal Paralysis*, called by Seguin *Tetanioid Pseudo-Paraplegia*, and by Chareot *Spasmodic Dorsal Tabes*, presents some distinctive features.

Symptoms.—Clinically there is incomplete paralysis, beginning oftenest in the lower extremities and slowly increasing, and after a

time there are rigidity and twitchings of the muscles. The twitchings occur in connection with voluntary movements, but are independent of the will, and are more likely to occur in the night. The rigidity at first comes on only with movements, but at length becomes permanent, with extension of the limbs. Pressure on the toes, or a rapid flexion of the part, causes tremor of the foot, and sometimes of the whole limb and other parts, which is called "reflex clonus," and by Brown-Séquard "spinal epilepsy." This condition gives rise to a peculiar difficulty in walking, which has been called the "spastic gait." The feet find an obstacle in every irregularity of the ground, each step is accompanied with a peculiar hiping elevation of the body, the patient gets upon his toes, tends to fall forward as he walks upon them, the legs are close together and held stiffly, the knees somewhat bent, and the manner of walking is thus quite different from that produced by simple impairment of muscular power or from the ataxic gait.

The tendon-reflex is even abnormally strong; sensibility is normal; the sexual function, and the functions of the bladder and rectum are unaffected; cerebral symptoms are absent; the muscles, for a long period, undergo no atrophy; and their electrical excitement is but slightly diminished. The progress of the disease is slow, and the case extends over many years, sometimes remaining stationary indefinitely; though sometimes it is progressive, so that the patient takes his bed. The diseased action, which is in the lateral columns, may extend to the medulla oblongata, causing bulbar or other forms of paralysis, and at last cystitis and bed-sores may occur, and death be the result. Generally, however, there is little direct danger to life, the patient usually dying of some intercurrent affection.

There are deviations from the typical form of the disease above described, but the general features are similar.

Etiology.—Its causes are obscure, but it is more frequent in men than in women, and commonly appears between thirty and fifty years of age.

Prognosis.—Some cases have been known to recover, and the chief danger to life which exists arises from the occurrence of bulbar paralysis or other complications.

Treatment.—The treatment is essentially the same as for other sclerosis of the cord. Early, alterative and antiphlogistic measures; later, electricity and hydrotherapeutics may be tried. From the spasmodic conditions present, strychnia is regarded as contra-indicated. It might, however, be thought to be indicated in small doses by those who believe that an alterative or antagonistic effect upon symptoms is sometimes produced by similars.

DISEASES OF ONE LATERAL HALF OF THE SPINAL CORD.

Diseases of one side of the spinal cord, resulting in loss or perversion of sensation on the same side of the body, with loss or impairment of muscular power on the opposite side, have recently been elucidated by clinical observations, *post-mortem* appearances, and experiments upon animals. These investigations have shown that the anterior or motor roots of the spinal nerves decussate in the anterior commissure, and that a second decussation occurs in the cord itself, independent of that which takes place in the pyramids. The same decussation does not take place in the posterior or sensitive roots, and hence in simple lesions of one lateral half of the cord there will be paralysis of sensation or anæsthesia on the same side with the lesion, and paralysis of motion or paresis on the opposite side. Thus in some lesions of one side of the cord in the lumbar region paralysis of motion will occur in one leg and paralysis of sensation in the other.

Dr. Brown-Séquard and others report cases establishing this fact, but there are numerous modifications of effects, depending upon complications and upon sympathetic actions between different nerve-centres. These cases are comparatively rare, and in a practical work need not be described in all their details, especially as the treatment will be governed by the character of the pathological changes rather than by the part in which they are located.

Morbid Anatomy.—The particular pathological lesions which may affect one lateral half of the cord are various. Hemorrhage producing rupture or pressure, pressure from tumors or other morbid growths, traumatic injuries, sclerosis, softening, or other degenerative processes may occur; and the special symptoms will depend upon the nature, the location, the extent, and the completeness of the lesions.

Prognosis.—This will also depend upon the character of the lesion. In the case of tumors, sclerosis, or abundant hemorrhage into the substance of the cord, the prospect of improvement is very slight. In hemorrhage in the spinal canal pressing upon the cord, in inflammatory effusions, and in rheumatic and syphilitic diseases, improvement, and in some cases recovery, may be hoped for.

Treatment.—The treatment must be governed by the general principles, many of which have already been indicated. The fact of the existence of anæmia or hyperæmia will afford the most important indications. When hyperæmia is present, belladonna, ergot, the bromides, counter-irritation, etc., will be indicated; when there is

anæmia, tonics, quinine, iron, extract of malt, codliver oil, etc., will be useful; and when exudates are to be suppressed or removed, means for increasing absorption should be used. Circulation, innervation, and nutrition should be promoted in the paralyzed parts. Iodide of potassium is very often required, and various salines may be prescribed. Fowler's solution is thought sometimes to be useful; and in advanced stages, especially where local anæmia may be suspected, strychnia and electricity may be the proper remedies.

Proper general nutrition and the regulation of all functions must be secured.

* DISEASES OF THE ANTERIOR COLUMNS OF THE CORD.

The same methods of observation and study which have thrown light upon diseases of the posterior and lateral portions of the cord, have also afforded knowledge of diseases of the anterior columns.

ACUTE ANTERIOR POLYOMYELITIS.—SPINAL PARALYSIS OF CHILDREN AND ADULTS.

Perhaps the most characteristic of the affections of the anterior columns of the cord is *Infantile Spinal Paralysis*. *Primary Atrophy of the nerve cells of the anterior horns of the spinal cord* is regarded by Charcot as the point of departure of this affection; and atrophy of these nerve cells is found in cases of this disease.

Pathological Phenomena.—Various morbid processes, however, are capable of producing this form of paralysis, such as *myelitis*, *cicatrization*, or *sclerosis*; all, however, coming on acutely and being situated in the gray substance of the anterior part of the cord, though the lesion may extend to other portions. Paralysis and imperfect nutrition of the muscles concerned follow, and very generally persist. The muscles, even after the disease has continued many years, merely present simple atrophy of the fibres, which have a finely granular appearance, with increase of nuclei and of the interstitial fatty tissue. The fibres are friable and their power is more or less completely destroyed.

Infantile spinal paralysis occurs in the first few years of life, and most frequently between the sixth and fourteenth months. The child may have been previously in good health, though it is often delicate in constitution, and not unfrequently one or both of the parents are affected with some nervous disorders. The vessels, doubtless, take an active part in the morbid process, and it is believed that the disease begins with medullary hyperæmia and vascular exudations. The nu-

trition becomes compromised, the nerve cells are impaired, secondary proliferations and other changes follow, with their results.

Inflammatory irritation and febrile movements accompany these changes, and these symptoms are among the early phenomena observed.

From a moderate inflammation of this kind recovery may take place, but when the delicate nerve cells of the child have become seriously compromised, the condition assumes a permanent form. Sometimes in the beginning of an attack the paralysis affects the upper extremities, but finally is confined to one or both lower limbs. This shows that improvement in parts of the cord may take place, and it may be inferred that this improvement may extend to all parts affected. The paralysis then may be temporary, but when the secondary structural changes of the nerve cells, the nerve roots, and the corresponding white columns occur, the paralysis is persistent.

Symptoms.—Infantile paralysis usually begins suddenly. A feverish attack occurs, with general symptoms of irritation, with restlessness, insomnia, cries, and not unfrequently convulsions, and sometimes delirium; when, after a while, the attendants notice that the child has lost the power of moving one or both of its lower limbs. The paralysis may extend to the trunk and arms, though usually it soon leaves the upper part of the body, but remains sometimes in both lower extremities, sometimes in one, and sometimes only in certain groups of muscles. It may affect the foot and hand on opposite sides, or the muscles of the trunk may be involved, resulting in lateral curvature of the spinal column. In some cases motion is re-established in one or two weeks, the electrical contractility not being materially changed; in others recovery takes place after several weeks or months. When the paralysis remains without improvement the nutrition of the muscles gradually declines, and the limb atrophies and grows cold and blue, especially the foot. Not only the muscles but the bones are arrested in their growth, they become thin, are shorter, and their vessels and nerves become atrophied. Sensibility at first may be exaggerated, but in time it usually becomes normal, and the same is true of reflex excitability. A want of balance occurring in the muscles, distortions often take place.

The epiphyses become atrophied, muscles and ligaments are relaxed, and subluxations may take place. Free passive motions may be allowed, though there is every degree of feebleness, atrophy, and loss of power. Faradic excitability of the muscles is apt to be weakened, and may even disappear, while the galvanic reaction is preserved for a much longer time.

Diagnosis.—This is not difficult where symptoms of irritation and fever precede, and where the paralysis comes on suddenly in the night. Some cases, however, are not so clear. Paralysis, secondary to acute cerebral affections, such as encephalitis, hemorrhage of the brain, or convulsions, assuming oftener the form of hemiplegia, but sometimes of paraplegia, may be confounded with spinal paralysis. But in these cases the previous appearance of brain symptoms, and the occurrence of the paralysis in the midst of partial or more decided convulsions with loss of consciousness, together with the subsequent character of the paralysis, will determine the character of the affection. In brain paralysis one side of the face may be involved, there may be loss or impairment of intelligence and speech, changes in the pupils, strabismus, etc., and yet there may be normal electrical contractility, even after years; and a normal temperature and a better state of nutrition are marks which will distinguish it from infantile spinal cases.

Paralysis of the limbs, which occurs in children from *chronic* brain disease, may be confounded with infantile spinal paralysis. But in these cases the disease comes on slowly, and with various cerebral symptoms.

Progressive muscular atrophy often quite markedly resembles infantile spinal paralysis. But *progressive* muscular atrophy, as its name implies, *extends* more or less rapidly and in a continuous manner, while spinal paralysis appears suddenly and commonly retrogrades to some extent; and progressive atrophy seldom occurs in children. This latter disease commonly begins in the face, especially in the orbicularis oris, causing a peculiar immobility of the lips, and the upper extremities are attacked before the lower.

The atrophy of certain parts of a muscle while others are normal, and a marked diminution or abolition of electrical contractility, are evidences of the atrophic affection.

There is sometimes a delay in the coördination of movements which prevents walking in children, but which is far different from the sudden suspension of power previously manifested.

The temporary paralysis of children, after exposure or from compression of the limbs, may be mistaken for spinal paralysis, but there is no change in the nutrition of the muscles or their electrical contractility, and if doubt exists at first, it will be removed by the favorable termination of the disease in one or two weeks.

Prognosis.—Whatever hopes may be entertained of recovery in infantile paralysis in the early stage, there is very little when the disease has long continued, and when the changes in the cells of the anterior horns of the cord may be presumed to have occurred. Still,

recoveries sometimes take place after considerable time has elapsed ; but if electrical excitability and motion have not returned after a year, there is no ground for further hope. The life of the patient, however, is not directly compromised by the continuance of the disease.

Treatment.—In the beginning of the disease the patient should be kept at rest, the febrile symptoms should be controlled, and a general antiphlogistic course pursued. Laxatives and diaphoretics cannot be amiss, and the bromide, perhaps with ergot, combined after a time with the iodide of potassium, is worthy of a trial.

In from two to four or six weeks, when the feverish symptoms have disappeared and the inflammatory condition may be presumed to have passed by or to have become chronic, electricity is the remedy most relied upon. A galvanic current should be passed from the vertebral column to the nerves and muscles, cautiously at first, and for a short period at a time, but repeated as may be borne. It should be persevered in for several months, and afterward it may be combined with local faradic excitement. Moist frictions, packing of the extremities, half-baths, and other methods of hydrotherapeutics may be useful. The circulation and nutrition of the muscles should be kept up by these means, while any hope is entertained of a change in the cells of the cord. Appropriate mechanical means for supporting the limbs should often be employed, passive motions, massage, and dry frictions should be persevered in, the moderate use of strychnia and other tonics may be of use, and proper management as to exercise and all other hygienic measures should be observed.

Acute *anterior spinal paralysis* sometimes, though rarely, occurs in the adult, and less rarely in older children. It is the same in its essential pathology as that which occurs in infants, though the initiatory febrile symptoms are less marked.

Phenomena.—The development is rapid, the distribution of the paralysis among the muscles is irregular, presenting a variety of particular phenomena; but the sensibility is not affected, though nutrition in the paralyzed muscles is impaired and wasting takes place. Reflex and electrical excitability is soon impaired and sometimes lost, but the functions of the rectum, the bladder, and the sexual organs are not affected. After a week or two improvement in some of the muscles usually takes place, and sometimes in all; and recovery may follow after several weeks or months. Very generally, however, a greater or less number of muscles remain permanently paralyzed; they soon become atrophied and distortions take place, but to a less degree than in children.

In some cases the onset of the disease is more gradual, and fever is absent, constituting a *subacute* variety.

A still more *chronic* variety sometimes occurs, simulating for a time progressive muscular atrophy, but distinguishable from it by the following characteristics: the paralysis precedes the atrophy, its character is less progressive, isolated portions of the same muscle are not affected, the lower extremities are first and chiefly involved, and the results are usually less unfavorable.

Treatment.—The principles of treatment are the same as in the more acute forms. In the early stage of hyperæmia and irritation, alterative and antiphlogistic measures are indicated, especially iodide and bromide of potassium, ergot, and belladonna. When the disease passes into the advanced stages, electricity, as in the case of children, is the chief reliance, but this may be aided by hydropathic measures, friction, and strychnine.

PROGRESSIVE MUSCULAR ATROPHY.—WASTING OR CREEPING PALSY.

This affection was clinically described by Sir Charles Bell, and has since been known to the profession; but for a long time it was supposed to be a local disease of the muscles, and only recently have the exact changes in the muscles been investigated, and the connection of the phenomena with certain changes in the anterior gray columns of the spine been ascertained.

Pathology.—Though there is not yet uniformity of opinion on this subject, a progressive degeneration of the cells of the anterior horns of the spinal cord is now regarded, perhaps by most, as constituting the fundamental lesion of the progressive muscular atrophy. This change in these cells may be primary, or secondary to other changes in the cord or brain. The morbid conditions which have been mentioned as leading to this are cerebral apoplexy, sclerosis of the lateral columns (which may extend to the anterior), lesions of the bulbar nuclei (which cause labio-glosso-pharyngeal paralysis), which may have a similar extension, central myelitis (idiopathic or traumatic), cerebro-spinal sclerosis, sclerosis of the posterior columns in ataxia, meningo-myelitis in vertebral caries, and hypertrophic spinal pachymeningitis.

Progressive muscular atrophy has been produced in animals by removing a portion of the sciatic nerve, the disease extending beyond the limb affected.

Post-mortem examinations of the muscles show that some preserve the normal red color, while others are pale or grayish yellow. Others present different degrees of change, and different parts of the same

muscle often present different conditions. Healthy muscular fibres may be side by side with others that have undergone fatty degeneration. Some fibres more slightly affected will show under the microscope a greater or less loss of their striæ, and occasional changed cells and drops of fat can be found in the interior, or in interspaces of the fibres. The muscles most seriously affected are softened, gelatinous, semi-transparent, and changed into amorphous fatty matter. According to Duchenne, restoration may take place after considerable advancement in degenerative processes has occurred, but general experience shows that muscles much degenerated in this disease are very seldom much improved.

Etiology.—The general causes of this disease are various. Sexual excesses, especially masturbation; exposure to cold; various acute diseases, such as typhoid fever, scarlatina, rubecula, acute rheumatism, the puerperal state, and a typhoid form of cholera, have been mentioned as among the causes. Over-exertion of groups of muscles in particular occupations, the male sex, and heredity are also regarded as influencing the production of this disease. The age in which it most often occurs is between thirty and fifty years.

Symptomatic Phenomena.—This disease during its first periods is distinguished by certain irritative conditions of sensation and motion. Sensations of cold air, of crawling insects, of numbness, of wandering pains, and fatigue on exertion are felt. Muscular efforts cause trembling; there are spasms and tension in the muscles, the fingers are stiff and inclined to remain in contact.

The movements of the thumb are readily impaired. The fingers and the whole hand lose their agility, the interosseous spaces are hollow, and the fingers become bent or claw-shaped. The forearm becomes progressively flattened, and the atrophy and paralysis extend to the arm, the shoulder, and the trunk; and finally to the lower limbs, to the muscles of respiration, of the tongue, and of the pharynx. Rarely the disease first appears in the shoulder, and it may have several points from which it spreads.

Pains, commonly dual, and sometimes tearing or lancinating, are added to the disorders of nutrition and motion, and are often severe in the region of the scapula.

Reflex excitability may be increased, fibrillary twitchings succeed to more general spasmodic actions, clonic or tonic, of the muscles affected, and sometimes there are shortenings of the muscles, producing contractions and subluxations of different joints.

The atrophy and paralysis do not always coincide. There may be little paralysis with more marked atrophy, or decided paralysis with but slight atrophy.

At first the temperature of the parts may be raised, but at a later period it is diminished, often a number of degrees, and the amount of creatin (which is the result of muscular action) is diminished in the urine.

Contractions and a slowness of responsive sensibility of the pupils sometimes occur, but there is no uniformity in this respect.

Herpes has complicated cases, and sometimes enlargement and other trophic changes occur.

The application of electricity gives different results in the different stages and conditions of the disease. In the diseased muscles electrical susceptibility may be either increased or diminished. Sometimes it is lost before a complete failure of voluntary power, but the latter soon follows the former.

This disease generally runs a chronic course, and may not prevent the patient from attaining an advanced age, but in other cases it may prove fatal within a year.

When the muscles of respiration and deglutition are early involved the danger is greatest.

This, however, is not common, these muscles being generally affected only after considerable time has elapsed.

It is thought to be less serious when it begins in the trunk than when it begins in the hands and extends upward.

The average duration of the fatal cases is about five or six years.

The average duration of the cases ending in recovery is something over one year.

Occasionally the progress of the disease is suspended indefinitely, and some labor can be performed, though the atrophied muscles are not restored to their former state. Usually, however, the disease is progressive, and the result, sooner or later, unfavorable.

Diagnosis.—Progressive Muscular Atrophy should be distinguished from *spinal meningitis*, and the febrile beginning of the latter, the more rapid progress, the tonic spasm of the neck, the local tenderness, the rheumatic origin, which is not infrequent, will establish the differential diagnosis.

Symmetrical sclerosis of the lateral columns, with degeneration of the anterior horns, *infantile spinal paralysis*, *diseases of the bodies of the upper vertebræ*, *traumatic lesions*, *hysterical paralysis*, *general lead palsy*, nodular rheumatism, etc., will present symptoms somewhat resembling those of progressive muscular atrophy, but a careful observation of the history and symptoms will generally lead to a proper distinction.

Treatment.—Whether the disease of the anterior column of the cord is primary or secondary, such disease is present and at an early

period, and profoundly influences the course and continuance of the paralysis. Like the other degenerative processes in the cord which have been discussed, it is probably hyperæmic and inflammatory in its origin, and in the early stages will require similar treatment.

The changes in the muscles, however, are early and important, and must receive attention. The changes of innervation produced by the central disease result in lowered vitality and nutritive action, indicating local stimulation. This is to be accomplished by frictions, shampooing, the use perhaps of stimulating liniments, and moderate exercise, but not carried to fatigue. The most effective agent, however, is *electricity*. Since the time of Duchenne this remedy has been greatly used in this affection, doubtless with benefit, but less brilliant results have followed its use than the writings of that distinguished author would lead us to hope. He advises to begin the treatment with a strong induced current, to be reduced in strength when the functions and irritability of the muscles have improved, so as to prevent too much excitement. The different forms of electricity may be used, often alternately but with care, according to the particular state and the effect produced. Interrupted galvanic currents may be passed from the vertebral column and plexuses to the nerves of the affected muscles. By means of these the entire groups of muscles may be acted upon. The descending current is preferably employed, but it should not excite too powerful contractions. In the extensive forms of the disease it is thought best to apply the constant current to the nerves and the induced current to the muscles.

When disorders of respiration or deglutition first make their appearance galvanization or faradization should be applied to the phrenic or the hypoglossal nerves. Currents may be passed along the course of the sympathetic nerves, but there is much obscurity about the sympathetic system, and the precise direction of isolated currents is not so exactly controlled as might be supposed. Though there may be much that is obscure, fanciful, and inexact in the application of electricity, and it may be injuriously applied, still it is an important therapeutic agent in various forms of paralysis, and in none, perhaps, is it more applicable than in this.

Attention to all the functions of the system, and general hygienic management, will, of course, be requisite.

PROGRESSIVE UNILATERAL FACIAL ATROPHY.

This is a rare form of disease, allied in pathology and phenomena to progressive muscular atrophy, affecting one side of the face, com-

mencing at the surface and extending to deeper parts, and involving the bones as well as the soft tissues. The skin is thin and changed in color; the beard, eyebrows, and hair on the affected side show the difficulty of nutrition by turning white, and often by falling out; the subcutaneous fat disappears; the muscles participate in the atrophic process, but to a less extent than the other structures; the cartilages as well as the bones are wasted; and the atrophy may extend to the tongue, the palate, and the uvula.

Etiology and Pathology.—Its causes have not been satisfactorily traced, and its pathology is unknown. It, however, occurs oftener in women than in men, and commonly before twenty-five years of age, and the left side of the face is oftener affected than the right. This disease is easily recognized by the deformity when it has made much progress, and it is distinguished from facial paralysis, the result of lesions of the portio dura, by the mouth being but slightly drawn to the opposite side, and by the muscular movements being preserved.

The progress of the disease is slow, and the patient, in other respects, may be in good health.

It doubtless depends upon suspension of the function of the trophic nerves supplying the part, probably from lesions at their origin; but no satisfactory demonstration of the special pathological cause has yet been made.

The disease does not endanger life, but the deformity, as it occurs mostly in women, is regarded as a great calamity.

Treatment.—So far it has not yielded to treatment, and a retardation or arrest of its progress is all that can be hoped for. Electricity is suggested and should be tried. Frictions and massage, judiciously conducted, may possibly aid in increasing nutrition.

DISEASES OF PERIPHERAL NERVES.

INFLAMMATION OF NERVES.—NEURITIS.

Inflammation of nerves is generally secondary. It is then either traumatic, or the result of the presence of a foreign body or of the extension of inflammation from surrounding parts. Of the latter we have examples in the intercostal pains in pleurisy and phthisis. Primary neuritis is usually produced by exposure to cold. Anatomically demonstrated spontaneous neuritis is rare; but as indicated by symptoms it is more frequent. In many of the pains which are spoken of as neuralgie, more or less hyperæmia and inflammatory changes, either in the nerve cylinder or its sheath, probably occur. It has been shown

that in herpes zoster the nerves supplying the part are inflamed. In carefully examining an inflamed nerve, it is found that both the neurolemma and the proper nerve element may be involved. The nerve is injected, ecchymosed, the color changed, it is swollen, softened by the change in the cells or by serous or gelatinous exudates, and sometimes fibrinous exudates are found between the bundles of fibres or in the neurolemma. The inflammation usually commences in the neurolemma or in the adjacent connective tissues, and extends to the myelin. We may have only perineuritis, though interstitial neuritis is apt to follow.

Neuritis may terminate by resolution, by absorption of the exudate, when restoration of function takes place; or by suppuration or neoplastic productions. Suppuration destroys the nerve; and in other cases fatty degeneration follows, while in still others the nerve is changed into a cord chiefly composed of fibrous or connective tissue. A nerve traumatically divided and followed by inflammation may be reunited by cicatricial tissue, and new fibres may form, and function be restored.

Symptoms.—When the inflammation of a nerve is limited, little or no fever is produced. If the nerve is superficial it may be felt to be swollen, and it is painful. The skin above it is red and painful, and there is often slight swelling; but the external appearances are changeable and uncertain. Generally the subjective symptoms are alone present. In sensory nerves there is much pain following their course, which is much increased on pressure. At first the peripheral excitement and the irritation and pain on pressure are great. As disorganization approaches and takes place, sensitiveness at the periphery diminishes and at length is lost, but the pain continues, constituting one form of painful anæsthesia. Impressions from the periphery, beyond the inflamed part, are not conducted to the brain; but those from the inflamed part or the proximal end of the nerve are conveyed to the sensorium, and pain is felt. It ceases when destruction is complete and the inflammation terminates. In inflammation of mixed nerves, there is pain, and at first spasmodic motions. At length paralysis results—motor, electric, and reflex. When the paralysis is complete and persists, atrophy of the muscles is observed as early as the second week, and it goes on rapidly.

When a purely motor nerve is inflamed, disorders of motion with but little change of sensation take place; and if the inflammation is severe and its course rapid, paralysis may occur without motor excitation. There is often changed nutrition in the tegument of the part supplied by an inflamed nerve, as the trophic fibres are involved. Vesicular eruptions are apt to occur, and in chronic cases discoloration

of the skin, and occasionally articular lesions result. Sympathetic effects are often produced in distant parts, and these are usually paroxysmal. In susceptible persons there may be general convulsions with or without loss of consciousness, and in the latter case the attacks resemble epilepsy.

Neuritis may be *acute* or *chronic*; and it may terminate in cure, or in paralysis, sensory or motor. The pain and other symptoms may persist after the inflammation is removed—the habit of wrong action being established. Sometimes the inflammation follows the nerve to its origin, and a variety of severe symptoms take place, and among them progressive atrophy.

Diagnosis.—Neuritis is distinguished from neuralgia by the pain being continuous, by its usually being accompanied by motor disturbances, by fibrillary contractions, and by the electric sensibility not being increased in the same manner as in idiopathic neuralgia. The existence of motor excitation distinguishes it from atrophy of the nerves or their contractions. Sometimes motor paralysis is the first thing observed, when the neuritis cannot be distinguished from compression of the nerve or from simple atrophy.

This peripheral paralysis from neuritis is distinguished from circumscribed central paralysis produced by lesion of the cord or brain, by the more sudden abolition of electrical motor excitation and the speedy atrophy of the muscles affected.

Muscular rheumatism is more diffused, not following the course of a nerve, and pain is increased from motion rather than from pressure.

Diseases of the vessels in the course of the nerves would be distinguished by the local disturbances of the circulation, often by objectively noticing the swelling of the veins, and by the œdema and venous stagnation so likely to be conspicuous.

Treatment.—In the early stage of neuritis, antiphlogistic remedies are called for.

In circumscribed cases, wet cups or leeches should be applied over the inflamed part. These should be followed by cold, or perhaps warm applications, as in other local inflammations.

Ice or ice-cold compresses often changed may be well borne. Anodyne poultices or embrocations sometimes procure more relief. When the pain is great, hypodermic injections of morphine will be called for; and later, revulsives, flying blisters, upon the surface of which morphine may be sprinkled. As a rule, in the severer cases, more or less paralysis remains. This should be treated by frictions, baths, and electricity, after the inflammation subsides. Galvanism may be used earlier than the induced current; and some advise that the former be used almost from the beginning, regarding it as having

favorable alterative or catalytic effects upon even the inflammatory process. In the idiopathic cases of neuritis, a favorable termination of the inflammation and the paralysis may be expected under the treatment advised. In the traumatic cases the results will depend upon the nature and extent of the injury. When foreign bodies are present, their extraction, if possible, is demanded.

ATROPHY OF NERVES.

Atrophy or wasting of the nerves is the result of a variety of conditions, central in the brain and cord, and peripheral in the nerves and their immediate surroundings.

Jaccoud recognizes three forms :

1. Mechanical ; as from a solution of continuity, separating the peripheral cord, or from contusions, pressure, etc.
2. Atrophy from inertia, where the lesion is central, impairment or destruction occurring at the source of function and producing cessation of sensibility or motion, or both, or destroying special senses, as vision or hearing, or the function of secretion of organs, as those of the kidneys, liver, etc. ;
- and 3. Spontaneous atrophy, which may be primary, or secondary to spontaneous neuritis. The latter often occurs in simple independent nerves, but may be in pairs or groups, or may become more extended.

Compression of nerves is a frequent cause of their atrophy in the first two varieties. The cause of the last, when not dependent upon inflammation, is obscure. Fatty, amyloid, and other degenerations take place. This form of atrophy is generally, however, attributed to cold and moisture.

The Anatomical changes observed are fatty, amyloid, and pigmentary degenerations ; cirrhosis, hyperplasia of connective tissue material, and thickening of the sheaths of the nerves, with wasting or obliteration of the proper nerve structure.

Symptoms.—When in compound nerves inflammation or compression precedes the atrophy, symptoms of irritation and pain, hyperæsthesia, isolated contractions, etc., occur. In other cases where capability of conduction is soon abolished, no pain accompanies the disease, but anæsthesia, motor paralysis, loss of reflex excitability, and electro-muscular contractility take place.

In purely motor spinal nerves, when divided, or when their function is entirely destroyed, abolition of reflex and electric contractility becomes complete by the tenth or twelfth day, and rapid atrophy of muscles follows. In the same lesions of cerebral nerves muscular atrophy is less rapid and complete, as there are fewer trophic fibres with

the cerebral motor. A lesion causing atrophy of a nerve, and consequent paralysis and atrophy of other tissues, may be at the root of the nerve, in its trunk, or in any of its branches; and the position of the lesion may be determined by the extent of the paralysis, and sometimes by the local symptoms. The paralysis and tissue changes in these cases are confined to the distribution of the nerve, and are not irregular as when the primary disease is in the muscle. The atrophy of both the spinal and cranial nerves may be limited and stationary, or it may be diffused. When muscular atrophy is limited, and has continued several months, the nerve must be regarded as atrophied.

Diagnosis.—Diffused spinal atrophy resembles primary progressive muscular atrophy, but is distinguished from the latter by the following features: The loss of motion precedes the diminution in size, the muscles lose their electric contractility, and the atrophy is grouped according to the distribution of the nerve.

Diffused sclerosis of the cord causes diffused paralysis, but unless the lesion involves the roots of the nerves, early atrophy does not occur, nor is reflex and electric excitability early lost, and the bladder and rectum are more likely to suffer.

Compression of the nerve roots often causes inflammation of the nerve and its results.

Treatment.—The treatment in these cases is that of nervous atrophy in general. The first object, however, is the removal, if possible, of the cause—the pressure, local inflammation, foreign substances, etc. When atrophy of the nerve has occurred, with the loss of power it entails, galvanism, electricity, sulphur and other baths, the salts of iodine, and tonics are the methods of medication required. Electricity as a means of diagnosis and of treatment is of great importance, and should be used with skill and often with perseverance; but when a nerve is to any considerable extent destroyed, it cannot be restored, and all therapeutical means are in many cases likely to fail.

NEOPLASMS OF NERVES.

Neuromata and morbid growths in nerves sometimes occur, and when within reach of the surgeon they come within his province. A swelling *en masse* sometimes takes place in the nerves of the stumps of amputated limbs, and they become extremely sensitive and painful. A proliferation of the connective tissue of the nerves, with the deposit of a colloid matter, at first gelatinous and later becoming horny, sometimes takes place, constituting what is called colloid de-

generation. It is oftenest in the intercranial nerves, but may be in the spinal.

Other enlargements of nerves from the size of a millet-seed to that of an egg—hard, elastic, usually movable with the nerve, and very sensitive to pressure—are sometimes seen. There are fibrous developments and other deposits between the fibres of the nerves, producing enlargements; and in other but much rarer cases there are *true neuromata*, consisting of bundles of nerve fibres mingled with increase of connective tissue.

The **Etiology** of these nerve tumors is obscure. The **Symptoms** are *pain*, generally paroxysmal, increased by pressure and made to radiate along the course of the peripheral part of the nerve; and symptoms of motor irritation are sometimes produced, and occasionally reflex convulsive movements are observed. *Cancerous tumors* sometimes are developed in nerves, are accompanied by pain, often by other cancerous deposits, and by the cancerous cachexia. They are less movable than the nerve tumors just noticed. They pursue the usual course of cancerous growths.

Ordinary non-malignant neuromata commonly run a chronic course. They do not threaten life, but they cause much suffering, inducing insomnia, indigestion, and general nervous derangements.

The **Treatment** is chiefly surgical, and consists in the removal of the tumors with the knife. As the nerve is included as a rule, and must be sacrificed, destruction of the function at the periphery is a consequence which cannot be avoided.

Anodynes for the relief of the pain will be suggested, and may be used as required.

Diseases of the nerves of the special senses of sight and hearing are treated of in works on ophthalmology and otology, and need not be particularly described here.

Diseases of the nerves of *smell* and *taste* have no special characteristics requiring a detailed account.

From disease of the olfactory nerves the sense of smell may be impaired or lost, or it may for a time be abnormally acute. From central irritation odors may be subjectively experienced in the absence of odorous substances.

These changes are rare as primary affections, but they not unfrequently occur in connection with various diseases, in fevers, rheumatism, etc., when they generally disappear with the original disease. They are most common in hysteria, and in this also they are transient.

The loss of the sense of smell is sometimes more permanent, as the result of central disease or of affections of the nasal membrane, as in some cases of catarrh. Aside from the removal of the dis-

eases which accompany it, *treatment* has little effect upon the loss of smell.

Electricity, however, is worthy of a trial in cases dependent upon failure of nervous influence.

Loss of the sense of *taste* is more rare, but its perversion and loss sometimes accompany other affections. Its *TREATMENT* must be conducted on the same principles as that of other forms of paralysis.

DISEASES OF CRANIAL NERVES OTHER THAN THOSE OF SPECIAL SENSE.

Diseases of particular nerves give rise to symptoms different in character and location, depending upon the function of the nerve and the part it supplies.

Diseases of motor nerves will produce abnormalities of motion, and those of sensory nerves of sensation, in the parts in which they are distributed.

Thus disease of the *third cranial nerve*, or the *motor oculi communis*, if of a character to destroy its function, will cause dropping of the upper eyelid or ptosis, diverging strabismus, protrusion of the eyeball, and dilatation of the pupils, as the several branches of this nerve are distributed to different parts, the loss of action of which produces these results. The loss of power in this nerve may be produced by a traumatic injury in its course, by the action of cold, or by overuse of the eye. When from the two latter causes it is usually functional, and will not be permanent. From change in the axis of the eye, so that an image will not fall on the same point of the retina in both eyes, double vision often results. The lesion may be intracranial, when it is seldom limited in its effects to the third nerve alone. Therefore, when it occurs, it often precedes or accompanies other severe affections—serious brain lesions, hemiplegia, convulsions, or coma. Ptosis, without other symptoms, indicates a peripheral lesion; and so do external strabismus and dilated pupils, as in the former case the upper branch, and in the latter the lower alone is involved.

A lesion of the *fourth cranial nerve*, the *patheticus*, produces less marked effects than that of the third. It, however, changes the axis of the eye, and usually induces double vision.

Disease of the *fifth cranial nerve*, from its extensive distribution and its compound character, produces a variety of effects.

When its function is completely destroyed, there is loss of both sensibility and motor power in a considerable portion of the side of the face supplied by the affected nerve, and trophic changes also take

place. Complete loss of power of the trigeminus is, however, rare. The sensitive or the motor part may be affected, or a limited number of more extreme branches alone may suffer. Loss of sensibility or motor power will then be confined to the particular parts supplied by the diseased or injured branches. Ulceration of the cornea, redness of the face and gums, and absence of reflex conduction are evidences that the paralysis is peripheral. When the lesion is cerebral or central, it is accompanied by other evidences of brain disease, and generally other cerebral nerves are involved.

Notwithstanding the loss of common sensibility and of motor power, pain is often experienced in the parts affected, produced by irritation of the part of the nerve nearer the centre than the obstruction, and from a projection of perception, such as occurs in an amputated limb from irritation of the stump. A lesion resulting in loss of power of the *sixth nerve*, the *motor externus*, produces converging strabismus and double vision. The third nerve is apt to be affected at the same time, and then the eye is fixed as to lateral motion, and double vision may not take place. This, as well as other cranial nerves, may be functionally diseased, when the effects are apt to be temporary.

Disease of the motor portion of the *seventh nerve*, or the *portio dura*—the more special motor nerve of the face—producing paralysis, is more frequent than that of the other cranial nerves. The paralysis produced by the complete loss of power of this nerve is marked and characteristic. The face is strongly drawn to the opposite side, especially when speaking or laughing; control over the orbicularis palpebrarum is lost, which destroys the power of winking or clearing the eye; the lachrymal secretion is not distributed over the conjunctiva, and it becomes dry and injected, and often inflamed, and sometimes opacity of the cornea follows. Loss of power over the orbicularis oris on the affected side causes inability to whistle or blow out a candle; the saliva often dribbles from the corner of the mouth, and certain sounds are imperfectly pronounced. The cheek on the affected side is flabby, and sometimes the velum palati is affected, and the uvula is drawn to the opposite side. These appearances are less marked when the loss of power is not complete. The hearing upon the affected side is often more acute than upon the other side, or than in health, and when the paralysis continues long, contractures of the muscles occur, and a striking and peculiar deformity results. The lesion in this form of facial paralysis is generally peripheral. If central, the paralysis is commonly preceded or accompanied by other symptoms of cerebral disease. If the nerve is affected in a situation to involve the *chorda tympani*, the sense of taste in the corresponding side of

the tongue will be impaired, and the salivary secretion will be diminished. When the arch of the palate is affected, the lesion is usually as deep as the origin of the branch supplying this part. If the sixth nerve be involved at the same time, the lesion is deeper at the origin of both these nerves in the floor of the fourth ventricle. When the lesion is central, as in other cases, reflex movement is retained; while if peripheral it is generally lost, and the paralysis is commonly more complete when peripheral. The paralysis of the face accompanying hemiplegia is usually less complete, and more control of the orbicularis palpebrarum is retained. Diseases of the ear or the parotid gland, accompanied by facial paralysis, indicate its peripheral character and the locality of the lesion.

Etiology and Prognosis.—This affection is often produced by exposure to cold, or to alternate heat and cold, inducing inflammation of the nerve. When it is dependent upon this cause, or when functional, the *prognosis* is favorable, recovery usually taking place after several weeks. If it continues much longer it is either pressed upon, or the lesion is more serious, and is much more likely to be permanent; and the prognosis is grave in proportion as the electro-contractility is diminished.

Bilateral facial paralysis has been observed, but it is rare. It may arise from lesion of both facial nerves, but it is more likely to be central. The face is then immovable and expressionless, relaxation of the soft palate may exist so as to cause an unnatural sound of the voice, which is increased by immobility of the lips.

Mastication is difficult, the saliva dribbles, the eyes are open and staring, and respiration is in danger of being interfered with.

Lesions of the *eighth cranial nerve* affect the pharynx, especially when that division called the *glosso-pharyngeal* is particularly affected. The local paralysis of this part occurring after diphtheria, indicates an involvement of this nerve in a lesion which is usually temporary.

A lesion of this nerve, together with the *par vagum*, occurs in various cerebral affections, often accompanied with coma and impairment, or loss of power of deglutition and respiration, resulting fatally. A small extravasation of blood in the medulla oblongata may produce these effects. As the vagus is an inhibitory nerve of the heart, its irritation causes slowing of the heart's beat, while its paralysis causes rapidity of the pulsations. When the *spinal accessory* is seriously involved aphonia results from paralysis of the vocal cords, while in lesions of the recurrent laryngeal nerve incomplete aphonia may be produced.

Lesions of the *ninth cranial nerve* on one side cause deviation

of the tongue when protruded, the apex pointing to the side of the paralysis. The reason of this will be understood when the mechanism of protruding the tongue is considered, and errors as to the direction of the deviation can be avoided by observing the influence upon the phenomena of the drooping of the upper lip, and projection of the teeth. Should both hypoglossal nerves be paralyzed, there would be inability to protrude the tongue or to articulate with any distinctness. In *bulbar paralysis* both of these nerves are usually involved.

Lesions of spinal nerves producing local paralysis need not be specially described in this connection. A variety of local phenomena follow which can be readily understood.

Lesions of the cervical sympathetic nerves produce peculiar effects which require some notice. The immediate results of a lesion of this nerve in the neck, sufficient to destroy its function, are congestion of the head on the side corresponding to the lesion, rise of temperature from increased nutritive changes, and contraction of the pupil on the same side. The vessels are dilated, and increased circulation of blood occurs in the parts from paralysis of the vaso-motor nervous filaments; and increased perspiration has been observed in the affected side of the head and face.

Functional changes in the sympathetic nervous system are not unfrequent, producing various abnormalities in circulation, nutrition, and other functions as met with in practice; but these changes are involved in more or less obscurity. Further experiments on animals and observations in human disease are required for a complete understanding of this subject. Many facts, however, are sufficiently established to give much interest to the subject.

Peripheral stimuli reach the sympathetic ganglia through afferent nerve fibres, and are conveyed by efferent fibres to unstriated muscles and the secretory cells. Automatic and rhythmical discharges of force from the sympathetic ganglia are also conveyed to unstriated or involuntary muscles and to secretory cells, so that both reflex and automatic or spontaneous actions, motor and secretory, excitatory and inhibitory, are taking place by the agency of the sympathetic system. Circulation, respiration, secretion, nutrition, and the various organic functions are thus controlled; and when the sympathetic nerves suffer lesions, a variety of morbid phenomena result. Diseases of the cervical portion, deranging the vaso-motor functions of the head and face, are supposed to have to do in the production of migrana, exophthalmic goitre, and unilateral facial atrophy.

Disease of the thoracic portion has to do with angina pectoris, with the pains which radiate from the heart to the thorax and arm, and with various derangements of the actions of the heart and lungs.

Diseases of the abdominal sympathetic cause various neuralgias and other functional disorders of the abdominal and pelvic viscera. Many of these special affections are described in other connections; and as the part which the sympathetic nerves perform in these derangements is not yet determined, each of them is treated of as an individual disease.

Treatment.—Paralysis is the chief symptomatic condition from the lesions of the nerves which have been mentioned, though other motor and sensory disturbances are produced besides trophic and secretory changes. These present various phenomena, according to the characters and extent of the lesions in each case. The more profound lesions produce paralysis, while others cause spasms, pains, and modified actions. The treatment of these paralyzes and other abnormalities will be governed by the pathological conditions causing them, and these must always be carefully inquired into. In the preceding discussion attention has been directed to the pathological lesions rather than to the results in the symptomatic phenomena. When the symptoms are dependent upon *neuritis*, distinguished by its proper evidences, the treatment for neuritis will be indicated. When they depend upon *atrophy*, either as the result of neuritis, of traumatism, of pressure, or of slow degenerative changes, these several conditions must receive attention. The principles of their diagnosis and management are elsewhere pointed out.

When they are central in their origin the treatment will be merged into that for the cerebral disease. When functional, the conditions giving rise to the morbid activities must be inquired into and removed. When arising from exposure to cold or alternate cold, and heat, as in laborers in furnaces, stokers, etc., a cure often spontaneously occurs in a few weeks, though the result may be hastened by some eliminative and antiphlogistic treatment at first, and by electricity and strychnine later. Syphilis is sometimes a cause, when antisyphilitic treatment will be important. Rheumatic inflammation in the surrounding tissues may involve the nerve, or rheumatic exudates may press upon it, when the treatment must be for the rheumatic state.

Iodide of potassium, as in other cases where inflammatory exudates surround a nerve or press upon it, will often be useful when such results of inflammation, whether specific or non-specific, are present. Indeed, it is more frequently indicated and more frequently useful than any other internal remedy in these lesions, as all the highest authorities now admit. Mercury in small doses is sometimes useful, hydrochlorate of ammonia and ergot have their advocates and uses, and various anodynes, both general and local, may be required where pain is great. Frictions and massage of the muscles are of use in keeping up their nutrition, so as to have them ready for action when the func-

tion of the nerve is restored ; and electricity, properly applied, will be found especially useful for the same purpose. Its effect in restoring the nerve function is more doubtful, still it may be useful for this purpose also. A séance of ten or fifteen minutes every second day is generally advised, using a more or less powerful current, as may be borne. Counter-irritation will sometimes be of service. The principles of treatment are the same in whatever nerves the respective lesions are situated, and need not be repeated in connection with the different local affections.

The remedies supposed to influence the morbid conditions of the sympathetic system are the bromides of potassium and ammonium, ergot, cannabis Indica, nitrite of amyl, croton chloral, chloral hydrate, conium, digitalis, atropia, veratrum, hydrocyanic acid, quinine, arsenic, and iron, and especially galvanism and electricity. Hygienic measures are also important, including management of the mind. These may be selected from in the management of cases where diseases of the sympathetic nerves are present.

PARALYSIS.

In many of the diseases which have been under consideration, *paralysis* was found to be a chief, and in some instances an almost or quite exclusive symptom. It has been the purpose to direct the attention of the reader to the pathological condition rather than the symptom, which is an evidence of the morbid state ; but occasionally cases occur where the pathological lesion is obscure or entirely undetectable, and the symptom presents itself as the chief if not the sole object of attention ; and even when the pathology of the disease is more clearly understood, the symptom requires not only careful observation but remedies directed to the relief of its phenomena, and to the prevention or mitigation of its consequences.

For these reasons it is deemed proper to add some observations upon this important symptom.

By *Paralysis*, as a general term, is meant a loss of power or of function in a part, whatever that function may be ; but the word is more particularly restricted to a loss of muscular power, or a loss of the control of the will over muscular movements. The term *Paresis* is often applied to this condition.

Paralysis is also sometimes used to signify loss or diminution of sensibility, and is qualified by the term *sensory* ; while loss of power over muscles is called *motor* paralysis. Sensory paralysis is now more commonly indicated by the terms *anæsthesia* and *analgesia*, the first

meaning loss of sensibility to touch, and the second loss of sensibility to pain.

There may be sensibility to touch without sensibility to pain, and in some cases, as we have seen, a part may be painful which is not sensitive to touch, though it is thought that in such cases there is a "projection of sensation" of the same character as when pain from irritation of a nerve in a stump is apparently felt in the absent limb. As a rule, anæsthesia carries with it analgesia. Anæsthesia may be complete or partial; and the degree of loss of sensibility, when partial, is best tested by observing the distance at which two points pricking the part are felt as one.

There are degrees of motor paralysis or paresis. In paresis the feeble motion may be steady or tremulous; and in complete motor paralysis no voluntary, and often no reflex or electrical motion is produced.

Motion is effected by muscles, and naturally they are excited to this motion by the nerves. The seat of this nervous power is in the brain, the spinal marrow, or the ganglia, which are hence called *nerve-centres*. The influence from the centres is conveyed to the muscles by the nerves.

Loss of power in a muscle may be produced by a lesion of the muscle itself, of the conducting nerve, or the originating nerve-centre. When the lesion is in the brain or cord it may be in the gray generating matter, or in the white conducting matter.

There are varieties of paralysis, according to its distribution. A paralysis may be general; but it cannot be complete in all the muscles without producing immediate death; though all the voluntary muscles may be paralyzed, for a time at least, without that result. Paralysis limited to a part of the muscles may affect those of one vertical side of the body, when it is called *hemiplegia*. When affecting the lower half of the body it is called *paraplegia*. When one limb is affected it has been called *monoplegia*, and when limited parts of the system are affected it is called *local* paralysis. To the latter various names are applied, according to its locality.

As we have seen, paralysis may be produced by morbid processes impairing structure—such as inflammation, atrophy, sclerosis, softening, etc.—either in the brain, the cord, or in the course of the nerves; by a solution of continuity, or other traumatic lesions, as in wounds, bruises, and apoplexy; by pressure on nerve-centres or nerves, from effusions, hemorrhage, hyperplasia, tumors, etc., and in some cases from congestion. Paralysis may also be the result of *poisons*.

Chloroform, ether, alcohol, opium, tobacco, and various other narcotic substances cause temporary suspension of power; and lead, arsenic,

and other articles may cause more permanent effects. Poisons generated in the body, such as urea, bile, the poisons of gout, rheumatism, *diphtheria*, and malaria may cause arrest of power. These produce their effects upon the nerve-centres or nerves, and possibly upon the muscles themselves.

In some cases the paralysis is *functional*—not dependent upon any perceptible structural lesions, but apparently produced by reflex irritations from the bladder, prepuce, uterus, stomach, etc.

Functional paralyzes not unfrequently occur in hysteria and in other derangements of the nervous system, sometimes of a mental or emotional character.

The functional cases are either local or paraplegic, but not hemiplegic, or very rarely so. Some of these are temporary, while others are more permanent; but they are generally more susceptible of cure than those which depend upon structural changes. The vaso-motor nerves have much to do in determining hyperæmia and anæmia of the nerve-centres and nerves, and these conditions have an influence in causing paralysis.

Paralyzes are divided into *central* and *peripheral*. In central paralysis the lesion is in the centres of nerve power, or at least in the brain or cord. In peripheral paralysis the lesion is in the nerves, or at least in the conducting element.

The leading characteristics of each of these have already been pointed out. In *central* paralysis, where the nerves are immediately connected with healthy brain or cord, and when the lesion is above that connection, the nerves and muscles concerned retain a comparatively healthy condition, and respond to all forms of electricity for a long time. At first, in the early days of hemiplegia following cerebral hemorrhage, while active changes are going on, there may be even heightened irritability of the nerves and muscles—more active response to electric and reflex excitement. From long disease, however, the excitability may be somewhat diminished, but generally there is no marked change in the faradic or galvanic susceptibility of nerves or muscles.

In peripheral paralysis which is complete, as where a nerve is severed from its connection with the brain or cord by a solution of continuity or by destructive disease, for a short time—a few days—the nerves and muscles may respond to electricity, sometimes actively. But degenerative processes, chiefly fatty, soon commence in the severed portion of the nerve, and are usually completed in six or eight weeks. In two or three weeks the muscles supplied begin to waste; and as soon as the degenerative changes begin in the nerve its electrical or faradic susceptibility diminishes, and soon is entirely lost.

When this is once lost, it is very slow to return. Where repair takes place, the susceptibility to the stimulus of the will may return before that to electricity. The portion of the nerve centrally connected will respond to electricity.

With the *muscles* thus severed from their nervous connection with the brain or cord, response to *electricity* is gradually lost; but according to Dr. G. V. Poor (*Lancet*, July, 1874), the response to *galvanism* is not lost but is changed in quality—is slower and continues longer.

These points are important in determining the precise diagnosis. They may be subject to variations; muscles when much wasted or degenerated may lose their susceptibility to all stimuli; but the general fact is probably as stated—response to galvanism is not entirely lost.

According to Erb, we have the electrical and other conditions of *peripheral* paralysis, with “degenerative reaction,” in the following diseased states:

1. In some forms of paraplegia due to destructive changes in considerable portions of the cord, so that the nerves enter an effete portion of the cord, and consequently receive no vitalizing influence from it;
2. In some forms of infantile paralysis;
3. In all forms of traumatic paralysis from injury of nerve trunks;
4. In “rheumatic” thickening of the neurilemma;
5. Any disease of nerve trunks or branches which interrupts communication with the brain or cord;
6. Lead paralysis.

By bearing these facts in mind, electricity will materially aid in the understanding of cases.

Diagnosis.—Other means of distinguishing the particular characters of cases must not be neglected.

The delicate coördination of movements required in the use of the vocal organs, the complex movements in various manipulations or acts of balancing and locomotion, may be impaired before more positive evidences of paralysis appear, and should be noticed in making an examination. Observing the state of the patient as to his intelligence and his emotional condition is important in determining the cerebral origin of the disease. The sensations of the skin, the conditions of the paralyzed muscles as to their rigidity, flabbiness, fullness, or wasting; the presence or absence of pain, of involuntary movements, of reflex actions, etc., should be carefully observed. The manner of walking and balancing, of speaking, of writing, the expression of the face, and, in short, all the conditions of the patient

must be observed and taken into the account in the examination of cases.

Principles of Treatment.—In the treatment of paralysis, of whatever kind, it is of the first importance to make an accurate diagnosis, and direct measures to the removal of pathological conditions. These means have already been discussed in connection with the particular forms of disease of the brain, the cord, and the nerves resulting in loss of power. The means for relieving the symptom of paralysis and its results in the different particular forms of the disease have also been pointed out.

A brief summary, however, of the general means required for the management of the symptom and its consequences, may with propriety here be given.

There are two leading indications, independent of the cause of the paralysis, to be fulfilled, viz.:

1, To preserve the nutrition of the muscles; and 2, to restore their action.

While acute irritation and inflammation exist at the seat of the lesion, stimulating or exciting measures, such as electricity and strychnia, should as a rule be avoided, and means should be used to overcome these irritative or inflammatory states.

Where the patient is confined to his bed, great care should be taken, in the lowered vitality of tissues, to prevent bed-sores, and in some cases the protracted water-bath may be demanded. Where there is sloughing of the sacrum and nates, the application of ice to the spine and the parts for ten minutes, followed by a warm poultice for three hours, is said to have a decided effect often in arresting the process. Old bed-sores will often be improved, and sometimes will heal rapidly, under a dressing of *balsam of fir*. This article spread upon a firm piece of linen or muslin, or upon soft leather, and applied over the whole ulcer, and removed once or twice a day, while at the same time, by air cushions and other contrivances, pressure is removed from the part, constitutes a method of treatment which in many cases has given great satisfaction.

When the bladder is involved, and the urine is retained or dribbles away while the bladder is not completely emptied, the greatest and most constant care is required to prevent retention and decomposition of the urine and inflammation of the viscus. The urine must be completely evacuated by the catheter at regular periods, and the bladder washed out. Proper care of the bowels will also be required.

In the management of the paralyzed muscle, Sir Thomas Watson's excellent advice must be borne in mind: "Our aim should be

to preserve the muscular part of the locomotive apparatus in a state of health and readiness, until peradventure that portion of the brain from which volition proceeds having recovered its functions, or the road by which its messages travel having been repaired, the influence of the will shall again reach and reanimate the palsied limbs." This object is to be sought in frictions, massage, passive exercise, and in the use of tonics, baths, strychnia, etc., and especially by the judicious use of *electricity* in some of its forms when it is applicable.

Some general rules for the use of electricity in paralysis may be given.

According to Dr. Poor (before referred to), the following rules should be followed :

1. If paralysis to the will remains absolute—if there be no voluntary action—and the muscles respond perfectly to electricity, no good is done by persevering with it.

2. If paralysis to the will remains absolute, while response to electricity is *diminished*, the electricity is useful in helping to improve nutrition of the muscles, and in tending to restore normal irritability. When this is accomplished and the paralysis is still absolute, the continuance of electricity will be of no use. When excitability and nutrition are diminished from want of use, then electricity may be continued. It tends with the other means mentioned to preserve such a condition of the muscles as to enable them to respond to a nervous influence should it be restored.

3. When in peripheral paralysis there is evidence of degenerative changes of the nerve, with atrophy of the muscles, *galvanism* is indicated, and should be long persevered with, as it may be rewarded by a gradual return of muscular excitability.

4. If the excitability to both forms of current—electrical and galvanic—has completely disappeared, a fair trial is proper, but it will probably fail, and its long continuance and the holding out of delusive hopes are not justifiable.

Efforts with electricity are most successful where pathological lesions have been removed and where their effects only remain, or where debility of muscles continues from desuetude. Then, too, frictions, shampooing, passive exercises, baths, and strychnine are more likely to be useful.

Functional paralysis—hysterical and reflex—and lead palsy are more susceptible than most other forms to electrical treatment.

In hysterical paralysis strong mental impressions will sometimes produce restorative effects which will appear quite miraculous.

Paralysis from Lead has repeatedly been referred to, and the general subject of lead poisoning was considered in connection with lead

colic. In the peculiar paralysis of the extensor muscles of the wrist the general remedies for lead poisoning must be used, iodide of potassium, in as free doses as can be borne, being the article most relied upon. This should be aided by electricity, by baths, by strychnine in many cases, and by other tonics.

In some rare cases a peculiar affection of the brain has been produced by lead poisoning, which has received the name of SATURNINE ENCEPHALOPATHY.

The symptoms are coma, convulsions, and delirium, sometimes one and sometimes another of these symptoms predominating.

They are not only variously combined, but are of different degrees of intensity, and of various special characters. Thus the delirium may be violent and aggressive, or more mild and hilarious, and the convulsions and coma may be more or less violent, profound, or persistent.

Other evidences of lead poisoning are usually present, which will determine the *Diagnosis*; and the *Prognosis* will vary with the severity of each case. In favorable cases an attack may disappear after one or two days, whereas in other cases the symptoms will increase in severity and become more persistent until death. The prognosis is grave in proportion to the frequency and violence of the convulsions and the degree and persistence of the coma. The proportion of fatal cases has thus far been large.

Treatment.—The treatment has not been established by large experience, but that which is applicable in lead poisoning in general will be indicated; and for the violent symptoms palliative measures, such as inhalation of chloroform, or the administration of chloral hydrate or bromide of potassium for the convulsions, the bromides for the delirium, and eliminatives, especially when the coma may be supposed to depend upon uræmia, will be indicated.

Diphtheritic Paralysis has already been sufficiently discussed.

FUNCTIONAL DISEASES OF THE NERVOUS SYSTEM.

The diseases of the brain, the spinal cord, and the nerves, which have been the subjects of the preceding account, are for the most part dependent upon some ascertainable structural changes, and may therefore be regarded as organic. There are various affections of the nervous system which are not accompanied with definite and discovered structural changes, and which, in the present state of our knowledge, may be spoken of provisionally as functional.

The functional diseases now to be considered may be cerebral, spinal, cerebro-spinal, neural, neuro-cerebral, neuro-spinal, or neuro-cerebro-spinal.

COMA.

Coma is a condition of unconsciousness which accompanies a variety of particular diseases, many of which have already been discussed, and as a symptom it has frequently been referred to. It sometimes occurs as the chief object of attention, and is not connected with any other form of well-recognized disease.

Coma as a cerebral affection resembles the physiological condition of sleep, but differs from it both in degree and character. Sopor is a word which is used to designate a condition between sleep and coma—an abnormally profound sleep. Physiological sleep is of the greatest importance to the system. It is a rest of certain of the functions, and affords the conditions of repair and recuperation. Coma is a pathological state which does not afford benefit to the organism. In coma, for the most part, there is a deficiency of the supply of oxygenated blood to the brain substance. It is a pathological element not only in various organic brain affections which we have been considering, but in various functional diseases, such as epilepsy, hysteria, and catalepsy, diseases to be considered. We have seen it to accompany not only particular brain diseases, but affections of the kidney and liver, pernicious malarial fevers, scarlatina, small-pox, and typhous and typhoid fevers.

It is also produced by the narcotic poisons—opium, alcohol, ether, chloroform, etc. Of the *modus operandi* of many of the causes of coma we are ignorant. The affection seems in some cases to be the result of cerebral exhaustion, as it follows excessive activity in conditions of impaired nutrition and of debility.

In cases in which it can be regarded as an idiopathic and functional affection, all other recognized diseases and the poisonous agents must be excluded.

Treatment.—In its treatment a careful diagnosis should be made, and the cause and pathological conditions should be ascertained. The most opposite methods may be indicated in different cases. If it depends upon hyperæmia and excessive blood pressure, depleting and revulsive measures are called for. If, on the other hand, it depends upon or is connected with depression or exhaustion, stimulating and supporting measures will be required. If the coma is dependent upon blood poisoning, eliminating, and at the same time supporting measures are commonly indi-

cated. If pressure be the cause, that, if possible, should be removed.

If serous effusions into the ventricles or the substance of the brain be the cause, hydragogues and diuretics, as can be borne, should be given. If it is produced by reflex irritations, as from worms or other irritating materials in the alimentary canal, they must be removed. The pulse here, as in so many other cases, must, to a large extent, be the guide in determining the course, as to depleting or stimulating measures, to be pursued.

Rest, proper alimentation, and the removal of all unfavorable conditions will be most important in those cases which might be regarded as idiopathic.

When poisons, whether from within or from without, produce the coma, antidotal measures will, of course, be indicated.

SPASMS.—CONVULSIONS.—ECLAMPSIA.—CRAMPS.

By spasms is understood irregular, abnormal contractions of muscular tissue. The term may be applied to every variety of such morbid contractions, whether of voluntary or involuntary muscles. The term convulsions is applied more particularly to irregular and involuntary contractions of voluntary muscles. By eclampsia is meant general convulsive movements of the whole body, with loss of consciousness, and more or less temporary interruption of respiration. By cramps is understood painful spasms, generally local, in particular muscles, voluntary or involuntary.

These morbid muscular contractions may be tonic—steadily continuous while they last—or clonic—interrupted at short intervals,—and sometimes there are alternate contractions and relaxations of flexor and extensor muscles of the limbs, producing somewhat rhythmical but aimless motions.

Spasms are frequently tonic, but convulsions are for the most part clonic. The tonic and clonic varieties of contractions may be mingled in the same case. An attack of eclampsia may commence in a tonic spasm and end in a clonic convulsion. Some convulsive movements are partly induced and controlled by the will, while others are entirely independent of the will, beyond or in opposition to it.

Voluntary motion is effected by an impulse conveyed from the brain through the nerves to the muscles, inducing their contractions. In convulsions an influence is conveyed through the same channels, but not from a voluntary effort. There is some morbid condition or excitement of the brain, the cord, or the nerves, when such abnormal

impulses are communicated, though reflex or sympathetic irritative action may produce the effect. These morbid excitations take the place of the will, and produce actions of an involuntary, irregular, and abnormal character.

Spasms and convulsions are always symptoms, and often of well-defined lesions; but sometimes they are the only distinguishable phenomena presented, and may be regarded as individual diseases. They occur under a variety of conditions, as we have already seen. They may be produced by cerebral hemorrhage; by intracranial tumors; by injuries of the head causing hemorrhage; by inflammations or their consequences; by diseased kidneys and uræmic poisoning; by syphilitic gummata; by peripheral irritation, as from worms or teething in children; by the puerperal state, and by large losses of blood, toxic agents, etc.

In our ignorance of particular causes in some instances, we are obliged to speak of certain convulsive fits as essential—eclamptic, epileptic, or epileptiform.

Convulsions are of every degree of severity and extent. They may be general, affecting all or nearly all the muscles of the body; they may be unilateral, affecting one side; or local, affecting particular muscles.

Children are particularly liable to convulsive attacks, and women more so than men.

Those peculiar to women and children need not be particularly dwelt upon; but most forms of convulsive attacks are common to all ages and both sexes.

The convulsions which often usher in the acute exanthemata and other fevers, those produced by organic diseases of the brain—hemorrhages, emboli, inflammations, tumors, injuries, etc.—have been noticed when these various diseases were described. So of uræmic convulsions, and those produced by local diseases or irritations, as irritations of the stomach, intestines, urinary or sexual organs, or of different peripheral structures.

General convulsions are commonly accompanied with unconsciousness, while in those of a local and limited character consciousness is commonly retained. In unilateral convulsions, however, consciousness is frequently lost.

Prognosis.—The conditions under which convulsions occur are so various, and their severity, repetitions, and continuance are so different, that a general prognosis must be very vague. However, death in a paroxysm, in those cases which are not symptomatic of serious lesions, is rare. Yet it sometimes occurs where *post-mortem* examinations can detect no structural changes; and occasionally the con-

vulsive act produces lesions, particularly of the brain, which may lead to serious and sometimes fatal results.

The prognosis as to the recurrence of attacks of eclampsia will depend upon the causes and character of the convulsions, and the constitutional peculiarity of the patient. When they arise from accidental causes which are removable the prognosis is favorable; but one who has had convulsions is more liable to their occurrence under irritating influences than are others.

Constitutional peculiarities, nervous impressibility, and hereditary tendencies have much effect.

Diagnosis.—The fact of a convulsive paroxysm is too obvious and striking to require any statement as to the method of distinguishing its existence; and yet convulsions have been so well feigned by malingerers as to deceive. They can seldom, however, succeed with an experienced and close observer. The change of expression, the deadly pallor or purple flushing, and the general character of the phenomena, are too peculiar to be successfully imitated. The *causal* diagnosis, and determining the particular class in which the convulsion is to be placed are more difficult. These will involve a consideration of all the preceding conditions of the case, as well as of those at the time of the attack.

Treatment.—The treatment of convulsions, depending as they do upon so many causes, and accompanied by such a variety of conditions, cannot be uniform, and yet there are certain remedies that are generally useful.

When convulsions are dependent upon local causes, such as irritating materials in the stomach or intestines, or irritations of other peripheral parts, these should be removed as speedily as possible. In the meantime there are various “antispasmodic” agents which diminish the tendency to convulsive movements.

The inhalation of chloroform, of ether, or, when the cutaneous circulation is suppressed, the inhalation of the nitrite of amyl, will often arrest promptly a convulsive attack. These agents should be inhaled in quantities sufficient to produce, if used in the normal state, at least approaching anæsthesia, and usually should be carried to the extent of overcoming the convulsive actions and causing the anæsthetic sleep.

Operating more slowly, but tending to prevent the recurrence of spasmodic actions, the bromide of potassium or sodium, or the bromide of lithium in free doses may be given. Asafoetida, valerian, and various other vegetable articles are supposed to have antispasmodic powers. Where convulsive attacks depend upon severe pain, hypodermic injections of morphine, or morphine and atropine, are

usually indicated. Where hyperæmia of the brain is apparent, cold to the head, and warmth or other revulsive applications to the extremities, will be called for.

Independent of the removal of the cause, inhalation of chloroform is perhaps most reliable for arresting convulsions, and the bromides for preventing their recurrence. The effect of the former is speedy though temporary, that of the latter is slower but more permanent, and they are by no means incompatible. A search for the cause should always be made, and its removal should be regarded as of the first importance.

Toxic Eclampsia.—Various poisonous substances produce convulsions. Inorganic materials and substances of organic origin—certain metallic compounds, irrespirable gases, and vegetable poisons, as conium, picrotoxin, curare—are among these articles.

The special consideration of these cases comes under the province of toxicology. Antidotal and symptomatic treatment will be required, into the details of which it is not proposed to enter here. When the poison is still in the stomach, emetics or the stomach-pump will be required, and the convulsions may be palliated by the various remedies which have been referred to. The convulsions are often accompanied by persistent coma, and electricity is often among the means which are useful.

Cramps are tonic local spasms, generally very painful and commonly temporary, though the term is sometimes applied, as in the case of writers' cramp, to more permanent conditions.

Cramps accompany other diseases, as colic, cholera, or other forms of active vomiting and purging; but they often occur as the only perceptible pathological state, as after fatigue, or from exposure to cold, etc. They are often relieved by pressure upon the muscles affected or upon the nerves leading to them.

Contractures are persistent shortenings of muscles from permanent contractions. Paralysis of certain muscles, with contractures of others, produces various deformities, coming more particularly in the department of orthopædic surgery. As a symptom of various brain, spinal, and nervous diseases, contracture has been referred to.

Tremor, or *trembling*, consists in irregular muscular movements, limited as to extent, and rapid in the succession of the contractions. It is a prominent symptom in some cases of cerebro-spinal sclerosis and in paralysis agitans. In most cases tremulous motions occur when voluntary efforts are made, but not in paralysis agitans. The tremors here are more constant.

The tremulousness of age is well known. A similar condition occurs in younger persons, the pathology of which is obscure, and for which remedies are ineffectual.

Tremulousness is not unfrequently the effect of toxic agents, alcohol, tobacco, mercury, and lead; and often, in milder forms, it is the result of the free use of coffee and tea. The remedy in these cases is the avoidance of the injurious articles. In chorea peculiar jerking movements are experienced, and in various acute affections, especially in low fevers, twitching of the muscles of the forearm, causing *sub-sultus tendinum*, is often observed. These all depend upon general conditions of the system, which may require treatment, though little can be directly done for the particular symptom.

Reflex Movements occur in normal conditions, but they are increased in some and diminished in other morbid states, as we have seen. They are sometimes excited for purposes of diagnosis, and the presence or absence of reflex excitability is of value in determining the character of a variety of nervous diseases.

Strychnia increases reflex action, while bromide of potassium often diminishes it. The increase and the diminution of reflex actions are seldom, though sometimes, objects of direct treatment.

PARALYSIS AGITANS.—SHAKING PALSY.

This peculiar affection occupies a situation between paralysis and spasms, and partakes of the character of both, though the spasmodic element is predominant, at least in the earlier stages, and is a precursor of the decay of motive power, which is likely to come at last. This disease is gradual in its approach, and slow but persistent in its progress.

Its onset is often preceded by symptoms of cerebral congestion, insomnia, irritability, and feelings of weakness or contractions in the limbs. It begins with slight agitation, usually first in the upper limbs, and is sometimes confined to particular groups of muscles. Alternate contractions of flexors and extensors, or of pronators and supinators of the forearm follow each other in quick succession, causing the agitating motion which gives the name to the disease. For a time these movements may be controlled by the patient to a greater or less extent, and they cease during sleep. They, however, increase in intensity, are aggravated by excitement or fatigue, extend often to the leg or one side, at length to the other side, to the lips, the jaw, the head, and, in fact, to nearly all the muscles of the body. The features become immobile, the movements of the eyes are restricted, the agitation becomes more constant, the voice is jerking and indistinct, swallowing becomes difficult; the muscles of the limbs and trunk, and particularly those of the neck, become rigid and comparatively power-

less; the head is inclined forward, there is a disposition to trot with the body bent forward in locomotion, and, as the disease progresses, paralysis supervenes in many of the muscles; the sleep is broken by the constant agitation, which is now uninterrupted; neuralgic pains are apt now to occur, various functions are disturbed, and at length the patient is worn out by continuous motion and suffering, or the paralysis extends to the muscles of deglutition, bed-sores may occur, or gangrene of the extremities, and death closes the scene.

At first the muscles respond normally to electrical excitement, but in time this diminishes, and psychical disorders, sopor, or delirium, are often concluding symptoms.

Morbid Anatomy.—Anatomical lesions, mostly of a sclerotic character, are sometimes found in the pons Varolii, tubercula quadrigemina, medulla oblongata, and other situations; but in other cases no such lesions are discoverable, and those peculiar to the affection are as yet unknown.

Charcot and Jeffroy have reported cases where there were obliteration of the central canal from proliferation of the epithelium, pigmentation of nerve cells, and amyloid corpuscles deposited in the pons Varolii. Further observations are required to establish characteristic pathological lesions. With improved methods of microscopical examinations and the use of reagents, we may hope for more satisfactory results in the future.

Etiology.—The causes of this affection are obscure, but prolonged exposure to damp and cold, excessive labor, mental shocks, etc., are thought to have an effect in its production. It seldom occurs before forty years of age, and its course is from a few months to several years.

Diagnosis.—This, in a well-marked case, is not difficult; but in the earlier stages this disease may be mistaken for chorea, for diffused sclerosis of the nervous centres, for senile trembling, for alcoholic tremors, for mercurial or lead tremblings, or for the effects of opium eating. A careful comparison of symptoms may be required to distinguish it from these affections.

Prognosis.—The prognosis is very unfavorable. Some mild cases have improved under treatment, but in the chronic or rapidly developing cases scarcely a hope of permanent improvement can at present be entertained.

Treatment.—The remedies that have been used for this disease are strychnine, ergotine, opium, curare, calabar bean, carbonate of iron, sulphurous mineral waters, Fowler's solution hypodermically, electricity, nitrate of silver, hyoscyamus, and hydrotherapeutic measures. Favorable statements have been made respecting the use of each of these

means by some, but they have been thought useless or of little effect by others. In the present state of our knowledge, treatment beyond that which may be indicated by obvious general or local symptoms must be regarded as experimental and of doubtful efficacy. It is often more satisfactory to the patient and friends to have some course of treatment pursued, but the prospect of benefit from medicine is so slight, that no article should be given which involves a risk of injury.

PSEUDO-HYPERTROPHIC PARALYSIS.

This is a form of disease hitherto observed in children only, and its more full consideration belongs to treatises on the diseases of children. It consists of a gradually approaching paralysis of the muscles of the lower extremities, and usually also those of the back, with enlargement of some of the paralyzed muscles.

Its causation, beyond the facts that it occurs in children, and that more than one case has been met with in the same family, is unknown.

Its morbid anatomy consists mainly in the increase of the connective tissue in the interstices of the proper muscular fibres, and the formation of fat in the same situation. The muscular fibres themselves dwindle, probably from the pressure to which they are subjected, and in time undergo degenerative changes. It is thought that at an early period of the change an œdematous state of the muscles contributes to swell their bulk.

The symptoms are obscure at first, and are apt to be overlooked or misunderstood. The child presents certain peculiarities of gait. He stands with his legs separated and his shoulders thrown back; he walks with his legs apart, and lifts his knees unnecessarily high, while his foot is somewhat extended, and sways his body from side to side at each step. During this stage, which may last from a short period to a year, enlargement of the muscles is not noticed, but at length this enlargement is apparent; the paralysis extends upward, is usually symmetrical, involving generally the muscles of the back and the trunk, those of the arms, and occasionally those of the face.

The degree and distribution of the enlargement vary in different cases, but the calves of the legs and muscles of the buttocks are generally more conspicuously affected. Some muscles even shrink in size, while in other cases nearly all the muscles of the body are enlarged, so that the child, though nearly unable to move, has the appearance of an infant *Hereules*.

The swaying gait from side to side is more exaggerated, the legs

are kept more widely apart, the shoulders are thrown farther back, there is great difficulty in rising from the sitting posture on the floor; the child gets on all-fours, and may be unable to assume the erect posture unless aided by placing his hands upon some higher object and pulling himself up. This state of things goes on gradually increasing for a year or more, and may then continue with little change for two or three years longer.

There is now an arrest of the enlargement of the muscles, and possibly a diminution by the contraction of the adventitious tissue; the child grows more and more helpless, and is confined to his chair or bed; but as long as respiration, circulation, and digestion are unaffected, life may be sustained, as no febrile phenomena are present; and, unless complications occur, there may be little suffering. There is no impairment of sensation or loss of control over the bladder or rectum, but the intellect is sometimes enfeebled, and there is imperfection of articulation.

Sooner or later the vital powers become enfeebled, and some intercurrent affection closes the scene. The disease is almost always progressive, and the child seldom lives beyond the period of adolescence.

Pathology.—This affection, though often considered in connection with diseases of the nervous system—with paralysis—is rather a disease of the muscles than the nerves, at least primarily, though intelligence and general nerve power are ultimately impaired. No lesions have as yet been discovered in the nerve-centres or the nerves.

Treatment.—This has thus far been unsatisfactory. Duchenne, however, is of the opinion that the disease may be arrested in its first stages by muscular faradism, aided by baths and kneading or shampooing.

When it has gone on to the distinct enlargement of the muscles and the advanced stages, no treatment has been known to arrest, or even delay, the fatal progress of the affection.

CHOREA.—ST. VITUS'S DANCE.

This is a neuropathic disorder characterized by irregular clonic spasmodic conditions of voluntary muscles, with imperfect coördination when voluntary movements are attempted.

Phenomena.—Though preceded sometimes by prodroma, indicating various nervous disturbances, the irregular movements are often the first indication of the morbid state. It is sometimes speedy in its development, especially when produced by sudden fright; ordinarily,

however, it commences in a few muscles and is moderate in character, but gradually extends to other parts and increases in severity.

There are many degrees of intensity in the spasms, and of frequency and persistency in their occurrence. They are sometimes unilateral, but much oftener both sides of the body are affected, though not unfrequently one side is more severely agitated than the other, and oftener the left side than the right.

The result of these spasmodic movements is often the production of very curious grimaces and gestures. They can usually be restrained for a time by an effort of the will; but while restrained the excitability seems to accumulate, and the motions for a time after such restraint will be increased. They are usually suspended or greatly diminished during sleep, though in some severe cases they are more or less continuous during that condition. The movements of the lower extremities are generally better controlled than those of the upper, so that locomotion is less affected than manipulations; but the gait is usually unsteady, and various ungainly motions of the legs and feet are observed.

The disease chiefly occurs in children from four or five years of age and upward, and in adolescents. Rarely, and sometimes in very severe forms, it appears later in life, but in such cases in connection with, and as the result of, organic cerebral disease.

Palpitation of the heart is a frequent accompanying symptom, sometimes with functional blowing sounds at the base; and as chorea sometimes has a connection with rheumatism, endocardial lesions with their proper signs are occasionally observed. Respiratory movements are often slow and sighing, and the tongue, when shown, is often protruded with a jerk and seized and held for a time with the teeth. The disease occurs more frequently with delicate than with robust children, and with girls oftener than with boys.

Its ordinary course varies from a few weeks to several months, the average two or three months, and it commonly ends in gradual recovery.

Pathology.—It has no well ascertained *pathological anatomy*, though a variety of lesions have been observed in individual cases. Minute embolic obstructions, especially in the corpus striatum, have been found in some fatal cases; foyers of softening, dropsical enlargement of the cells of the cerebral cortex, proliferation of connective tissue of the brain or cord, softening of the cord, hyperæmia of various parts, and pigmentations have also been seen by different observers; but as no uniformity of structural changes has as yet been discovered, those that have been noticed are regarded as accidental complications, rather than necessary elements of the disease.

The recovery in ordinary cases is complete, indicating that if structural changes have existed they have been removed; relapses, however, not very unfrequently take place, but probably from the general condition of the nervous system, or from some peripheral disturbances, rather than from the continuance of cerebral or spinal structural changes. From some experiments upon choreic dogs conclusions have been drawn by some that chorea has its location of irritation either in the nerve cells of the posterior horns of the cord, or in the fibres which connect them with the motor cells. But experiments upon animals, as well as clinical observations, have shown an influence of brain lesions upon choreic movements.

A girl of thirteen years of age is at the present time under my care, who has partial hemiplegic paralysis of the right side, accompanied with choreic movements confined to the same side. This affection followed an acute attack of what was pronounced cerebro-spinal meningitis, which was succeeded by pain on the left side of the head, mostly near the base of the brain. The unilateral character of the disease, the pain in the head, and the history of the case indicate an inflammatory lesion of the cerebral meninges or its results as the cause of the affection. This must be regarded as a symptomatic rather than an idiopathic form of the disease, and differs from the cases of chorea ordinarily met with. Its subsequent history may prove to be quite different from that of the ordinary forms of chorea.

Etiology.—The special causes to which chorea has been attributed, aside from age and sex, are hereditary influence, menstrual and other sexual derangements, chlorosis, sudden fright, and articular rheumatism. The rheumatic complication is, judging from the reports of cases, much more frequent in England than in this country. This is doubtless due to the greater prevalence of rheumatism in that damp climate, and among a people whose habits, especially those of the children, differ so much from ours. The simultaneous occurrence of these diseases may be a coincidence, and does not prove a causative relation between them. Still, in this country the two affections occur, perhaps, too often in connection to allow us to consider their association entirely accidental.

Diagnosis.—The diagnosis in all ordinary cases is not difficult. Its occurrence in children and its very characteristic symptoms are unmistakable. As it appears in adults it has some resemblance to paralysis agitans; but the peculiar gait, the deformity of the hands, the constancy and rhythmical character of the movements in the latter disease will distinguish it from the “insanity of the muscles” of chorea. Spasmodic tic is paroxysmal, usually symmetrical, but confined to the face and neck. Muscular twitchings and shock of the

entire body sometimes occur from acute meningeal disease of the brain and cord, and tumors and other grave brain affections are sometimes accompanied by choreic movements; but there will be in these cases other evidences of these morbid states.

Prognosis.—The prognosis of idiopathic chorea, as already intimated, is very favorable, there being the strongest tendency to spontaneous cure within a few weeks or months; but very rarely cases become chronic, the patient being affected with choreic agitation for years; occasionally feeble patients may be worn out with the constant movements; and sometimes the convulsive agitations are so violent as to induce serious bruises and excoriations. Intercurrent affections may of course induce a fatal termination. I witnessed one case in a man about thirty, affected with purely choreic symptoms, but of so violent, constant, and uncontrollable a character, that in a few months he was worn out and died from exhaustion. Toward the last his agitations were so violent that physical restraint was necessary to prevent the most severe contusions, and the destruction of furniture in the room. He had no fever, his mind was clear, and no symptoms other than the choreic were present. Chloroform, chloral hydrate, morphine, and other narcotic and anodyne substances were given with but slight and very temporary effect. This was the only death from apparently uncomplicated chorea I have ever witnessed. No *post-mortem* examination was obtained.

Treatment.—In all diseases which are persistent for weeks and months many remedies are used, and in those which terminate spontaneously many remedies obtain the credit of cures. Both of these conditions exist in the ordinary case of chorea, and as a consequence many remedies particularly directed to the choreic state have been used in this affection, and many have been extolled. There is uncertainty respecting the efficacy of most of them; but still, in some cases at least, treatment is of decided service.

The indications that present themselves are, 1. To remove apparent morbid states, such as constipation, worms, amenorrhœa, anæmia, rheumatism, etc.; 2. To subdue cerebral and spinal congestion, if present; and 3. To try specific alterative treatment—the particular remedies for the choreic condition.

Constipation of the bowels is often present, and in such cases there can be no doubt of the utility of cathartics or laxatives. Indeed, where there is no constipation, but where there is evidence of fullness of the system, and especially of portal congestion, and hyperæmia of the brain or cord, repeated cathartics are of decided service. In all cases the bowels should be kept open.

In cases of anæmia and debility, after or in connection with proper

evacuants, tonics, particularly preparations of iron, are indicated. They can often be combined with strychnine and other vegetable tonics with advantage. In chlorosis and amenorrhœa a similar course must be pursued, with the addition of such emmenagogues as may be thought appropriate. If irritation of the sexual organs, either in the female or male, from any cause is present, it should be removed by proper means. If dyspeptic symptoms are present, they should receive proper attention. In cases of nervous exhaustion, rest in bed, with restricted diet, chiefly of milk, but gradually increased until a fuller diet is allowed, with frictions, shampooing, etc., may be of great service.

In cerebral and spinal congestion, purgatives from time to time, and bromide of potassium, ergot and belladonna, as in other cases of hyperæmia of the parts, may be specially useful. In short, the removal of all unfavorable conditions, by rational means adapted to them, constitutes the most important part of the treatment.

When such special conditions do not present themselves in a case, or having appeared are removed, and the choreic symptoms continue, and indeed often in combination with these rational methods, more specific antichoreic remedies may be resorted to. The more specific modes of treatment are various. Those which have most authority in their favor, and those which have seemed to me most efficient, will be mentioned.

Certain anodyne and soothing agents tend to diminish the irregular motions and procure rest. In some cases the bromide of sodium, potassium, or ammonium will exert a beneficial effect by procuring rest and more quiet sleep. In anæmic cases they may increase the debility, if pushed to a great extent, but generally they will be well borne and will not interfere with other measures. They may or may not be needed. In more violent cases of great restlessness, morphine and chloral may be tried, either separately or in combination. As a rule, in ordinary cases these powerfully narcotic agents should not be given. Arsenic has long enjoyed a reputation in this disease, and when commenced in ordinary doses and increased gradually, large doses will often be borne. It is advised to commence with Fowler's solution, in doses of from four to six drops, well diluted, three times a day for an adult, gradually increased to ten or more drops, or until its constitutional effects are observed. Continued in such doses as can be borne, it is believed to often cut short the disease. Some advise its use hypodermically, in obstinate cases, diluted with an equal quantity of water. Different preparations of zinc have also a reputation, and the sulphate is perhaps the form more frequently prescribed. It, too, is given in gradually increased doses to the full extent of the tolerance

of the system. The valerianate or oxide is also given, and may be to the extent of a scruple a day.

Trousseau strongly recommended the use of strychnia, to be given in gradually increasing doses, and Hammond advises the same plan. The latter advises that two grains of the sulphate of strychnia be dissolved in an ounce of water, and to a child from ten to fifteen years of age five minims should be given three times a day. This contains about the fiftieth of a grain of the medicine. The next day six minims are to be given at each dose, and so on, increasing the dose each day until stiffness of the limbs is induced. Then return to the original dose, and increase again until some physiological effect is produced. According to the statement of Sée, of Paris, it has not been as successful with him as with Trousseau and Hammond.

The tincture of calabar bean (five parts by weight of the bean to thirty-five of alcohol, ten to twenty drops three times a day) has been praised. Opium in decided doses, continued a few days, has also been praised; and conium, cimicifuga, gelseminum, and various other articles have had their advocates.

The ether spray applied to the spine from the occiput to the sacrum, for ten minutes every day, or every second day, is thought to have a decided effect; and Hammond states that ten applications are the most he has made use of, and that "a cure has always been obtained within two weeks." Strychnine was given at the same time, but it is not mentioned at what period of the disease this treatment was commenced. If it was near the beginning, the success has been extraordinary; if later in the disease, nature may have done the work. It is to be regretted that when statements of extraordinary success are made, fuller particulars are not given. Where confidence in the carefulness with which facts are related and inferences are drawn is not great, any want of fullness and explicitness in reports of success deprives them of much of their value.

Electricity in different forms has been praised by some, and thought to be of little value by others.

Rosenthal says: "From my experience in a large number of observations, I give the preference to the continuous current, a stable current of moderate intensity being passed from the vertebral column to the nerve of the affected parts (from three to five minutes)." "In many cases the muscular spasms improve very rapidly, at other times several weeks elapse before any good effects are produced." Here, too, the statements are too vague to be of much value. We should know at what period of the disease the treatment was commenced in the cases that improved rapidly, and in those that did not improve until after several weeks. It should be borne in mind, in estimating the

value of any treatment, that many cases recover without therapeutical measures in the course of a very few weeks.

Hydrotherapeutic measures have been used with reputed success. Moist packs, followed by half baths, frictions, and douches are advised. Gymnastic exercises—regular and systematic movements—best to music, have been thought to be of service, and may be very useful in breaking up habits which sometimes continue after the primary cause has ceased to act.

In my own experience more dependence has been placed upon fulfilling rational indications, than upon any specific measures for arresting the choreic state.

CHOREA SALTATORIA.—CHOREA GERMANORUM.

A peculiar nervous disease, allied in some respects to chorea, and which is termed by German writers *Chorea Saltatoria*, “consists of spasmodic movements occurring paroxysmally in certain groups of muscles, and presenting the appearance of voluntary motor directions.” The patients, against their sense of propriety or by an impulse they do not control, execute various motions, sometimes simple, and sometimes with extraordinary combinations difficult to be performed in the normal condition, and which are repeated under peculiar mental excitements. These motions vary greatly, and are often preceded and accompanied by other symptoms of nervous derangements, such as pain in the head or spine, palpitation, dyspnoea, agitation, illusions of sight, etc.

In the paroxysm the patient may run, jump, hop, dance, climb, whirl around, move the head and body backward and forward (*salaam convulsions*), project the tongue, pound some object, imitate the noises of animals, declaim like actors, sing, recite poetry, or indulge in extemporaneous effusions. Some cases are accompanied with ecstasy, with anæsthesia, with more or less loss of muscular power, or with cataleptic or tetanic symptoms. Paroxysms of this kind may continue from a few minutes to many hours; and in some cases the same motions may continue to be made for indefinite periods. The more general paroxysmal excitements subside, sometimes gradually, and at others abruptly; the patient, where much force has been put forth, feels languid and is disposed to sleep. Malaise, irritability, and eccentricity remain, and paroxysms are likely to occur for indefinite periods.

Pressure at certain points, or the application of the poles of a battery, may either arrest or excite movements, and it is well to seek for

these points in the management of cases. Patients affected in this manner are often hysterical, some are epileptic, and others are insane.

The resemblance of this disease to insanity is striking. The acts are performed to a large extent through the influence of the will, but the will is perverted by disease, and morbid impulses control its actions. There is an abnormal state of the impulses and the will, resulting in unsound (insane) muscular acts.

The disease in question may come on spontaneously, may be the result of sympathy and irritation, when it may assume an epidemic form; or it may be induced by certain manipulations and voluntary efforts by others, the patient generally assenting. This comes under the head of what has been called animal magnetism, hypnotism, artificial trance, etc. It is sometimes the result of intense mental or emotional excitement, particularly religious, and takes different forms of expression according to the prevailing mental state of those concerned. The intense contemplation of the mysterious disposes, in susceptible persons, to various manifestations resembling those which have been described. Psychical rather than physical abnormalities are more prominent in some cases, and strange mental as well as muscular gymnastics are performed.

Treatment.—The treatment of these cases will consist essentially in removing the causes that produce the affection, breaking up the habits which may be formed, and strengthening the nervous system. Derangements of the secretions, morbid states of the sexual system, anæmia, dyspepsia, the habitual use of narcotics, and whatever injurious influences or states may be discovered, should receive attention and appropriate treatment. The mind should be diverted into other channels of thought and feeling, new scenes presented, and a general tonic course of treatment will often be required. Iron, quinine, strychnine, bathing, proper exercise, and obedience to all hygienic rules will be important. In obstinate cases electricity and various neurotic remedies may be tried. The milder antispasmodics, rather than the narcotics, should be preferred, though the latter may be needed for temporary quieting effects in violent cases. Habits of narcotism, however, should be carefully guarded against.

Awkward muscular tricks, such as twitching of some of the muscles of the face, contraction of the nares or other motions of the nose, more or less frequent and rapid, or peculiar winking, etc., sometimes occur as fixed habits. Affections of this kind, especially if temporary, might be called chorea minor. Before the habit is fully established, such motions may be arrested by a determined action of the will. After long continuance they usually go on triumphantly to the end.

ATHETOSIS.

This is a rare affection, described some years ago by Dr. Hammond, which is characterized by spasmodic actions of the fingers and toes constantly occurring, and which does not allow them to remain in any one position in which they may be placed. A single case only of this affection has come under my observation. It occurred in a railway conductor, was nearly identical in its manifestations with the cases described by Hammond, and was similar to cases described by S. Weir Mitchell and Charcot. The fingers of the left hand, in this case, were in constant motion during his waking hours, constantly in a state of tension, and often widely spreading, with very limited control of them by the will. Pain in the part preceded and accompanied these movements, and the patient was unable to follow his occupation, and was the subject of severe suffering. The other extremities were slightly affected, but the chief difficulty was in the left hand. The case was soon lost sight of, and the subsequent history is unknown.

The *Pathology* of this affection is not understood, the history of the cases that have occurred furnishes little hope of cure, and the best plan of treatment is by no means established. Electricity and bromide of potassium have been used by Hammond, Gower, of London, and others, with alleged relief, but have not effected a complete cure. Of these remedies, the bromide in full doses seems to have been most efficient.

CATALEPSY.

Phenomena.—This is an intermittent neurosis characterized by a temporary abolition of motor power, but in which the whole body, or the part affected, retains in a state of rigidity the position in which it is placed or which it occupies at the time of the seizure. The spontaneous paroxysm lasts at least for several minutes, and sometimes as many hours. The muscles at first are markedly rigid; and considerable force is required to change the position of the limbs, but soon this rigidity is diminished so that the parts can be put in other positions by a very moderate external force, though they still retain the positions in which they are placed. This latter condition is known as *waxen flexibility*.

The mental state varies. Consciousness is generally lost in severe attacks, while in other cases it is retained, but often is more or less obscured. There are various disorders of sensation where conscious-

ness is not lost. Anæsthesia is frequently present, sometimes general, sometimes upon one side of the body, and sometimes in limited parts. In other cases abnormal sensations are experienced, and reflex excitability is changed.

Pathology.—There are various speculations respecting the nature of catalepsy, but, beyond the fact of its being a morbid state chiefly of the motor portions of the brain or their connections with the muscles, little is positively known. As death rarely if ever occurs from the simple cataleptic state, opportunities for *post-mortems* are rare, but a few such examinations have been made of persons who have died while laboring under the affection, and have shown changes in the corpus striatum and in the cortical zone of the anterior lobes; but these changes may not have been connected with the catalepsy.

Etiology.—The causes of catalepsy are various. The hysterical temperament gives a predisposition to the disease, and it is excited by many of the conditions—emotional excesses, suppression of the menses, unsatisfied love, etc.—which excite hysterical attacks. Over-excitement of the intellect and the feelings, religious exaltation, dwelling upon the mysterious, unusual mental concentration, nervous exhaustion, etc., dispose to spontaneous attacks. As is the case with some of the allied affections that have been noticed, catalepsy may be induced by influences from without, by what are called mesmeric processes. Young females not far from the period of puberty are more subject to it, but it occasionally occurs in older persons and in males.

Diagnosis.—The diagnosis is made by observing the characteristic symptom, especially the “waxen flexibility,” which belongs to no other disease. Simulation of it may be attempted, but it is difficult to remain long voluntarily in a fixed position without starts or tremors, and the application of electricity, or of needles, will usually bring a case of feigning to a close.

Prognosis.—Simple catalepsy is free from danger to life, and recovery usually takes place in time. In the peculiar constitutional condition predisposing to it there is a tendency to relapses.

Treatment.—The protracted fits may require treatment, though in ordinary cases a spontaneous termination soon occurs. A few whiffs of nitrite of amyl, a dose of asafoetida, or some other antispasmodic may have some influence. If necessary, in protracted cases food may be administered by placing it far back upon the tongue, when deglutition will commonly take place, or the œsophageal tube may be used and liquid food injected into the stomach. The principal treatment should be directed to the prevention of attacks. This

is to be done by removing the causes, diverting and disciplining the mind, and strengthening and soothing the nervous system.

Iron, quinine, strychnine, bromide of ammonium, proper alim-entation, rest when there has been overwork, change of air, mild hydrotherapeutic measures, the gentle use of electricity, etc., may be of service. Spontaneous attacks of catalepsy are very rare in this country, and the induced attacks are of course to be avoided by abstaining from the means which induce them. The following features are to be observed in catalepsy, viz.: It is rare and is allied to hysteria; is not dangerous; may be induced; and should be treated much as hysteria.

Experimentation in proper hands for the discovery of physiological and pathological truth may be justifiable, but frequent and indiscriminate tamperings with the nervous systems of susceptible persons should be condemned.

ECSTASY, TRANCE, AND SOMNAMBULISM.

These conditions are allied to those which have been mentioned, but each presents peculiarities of phenomena. By *ecstasy* is understood a state of mental concentration, excitement, and exaltation, in which external impressions are comparatively or entirely unnoticed. The organic functions go on without serious interruption, but motor and sensitive functions are often modified or suspended. A cataleptic condition is sometimes conjoined. The chief phenomena, however, are of a psychical character. The mind is intense in its movements, visions are experienced, usually of an exalted character, and are generally remembered.

By *trance* is understood a similar condition, but still more profound. There is generally entire insensibility to outward impressions, or at least inability to respond to them, and the organic functions, respiration and circulation, are often exceedingly feeble, the respiratory movements and the heart-beat being discovered only by the most careful examination. Intellectual cerebration goes on, but is uncontrolled, much as in dreaming, though the visions and the emotions are so intense as often to be remembered with great distinctness. These paroxysms have continued not only for hours but for days, and sometimes present very curious physical and psychical phenomena.

Somnambulism, or sleep-walking, an acted dream, is a state in which acts are performed, such as rising from bed, dressing, walking, writing, or doing various things requiring skill and care, but in a

state of suspension of some of the mental faculties, and particularly of consciousness. In this state, which may occur spontaneously or may be induced, the individual may be under the control of another, obeying every suggestion made ; or the action may be spontaneous and independent of such control. These induced conditions are called *hypnotism*, *animal magnetism*, *mesmeric trance*, etc., and are among the phenomena which have been the subjects of unreasonable skepticism on the one hand, and extreme credulity on the other, and which belong to the unexplored mysteries of our complex being. The conditions of this nature are far from being uniform in their character and particular phenomena.

Consciousness is usually perverted or suspended, but it is sometimes entire, and often what occurs in this state is retained in the memory.

Independent volition is often suspended, but not always, though it generally obeys the suggestions of the person with whom the patient is *en rapport*.

Many, though not all the actions of the subjects of these experiments are automatic and reflex. There is generally a concentration of the mental activity in one direction, with more or less suspension of powers in other directions.

Often there is suspension of inhibitory functions or of the controlling faculties, and the mind pursues erratic courses, not the result of any special concentration or conduction. There is often a want of coördination of the mental acts, and yet they are sometimes both exalted and consistent ; but there is an unstable equilibrium, and the nervous energies may be concentrated, inhibited, or perverted, the most common condition being that in which there is an exaltation of some faculties of sense and of thought, with a more or less perfect suspension of others.

The variety of phenomena resulting from these conditions is almost unlimited. There is much unconscious and uncontrolled cerebration, producing strange results, which have induced the belief in many of spiritual influences from an unseen sphere, or the interposition of spiritual beings in the persons and the affairs of mortals.

The observations and experiments of Charcot and many others of scientific reputation are redeeming the subject from the domain of charlatanism ; and although important practical results from their investigations are delayed, no scientific truth can be without its ultimate fruits.

Treatment.—In the spontaneous abnormalities the same general course of treatment is indicated as in chorea Germanorum, and in catalepsy. The removal of the causes, the soothing and strengthening of the nervous system, and the breaking up of wrong physical

and mental habits which may have been formed, are the objects to be accomplished. The same means for these purposes which have already been described will be required.

In *induced* or *sympathetic* forms of these diseases, such as are caused by mesmeric processes, by intense excitements, or by sympathetic moral contagions such as occurred in the Middle Ages, and are described by Hecker under the designations of the "Dancing Mania," "Tarantism," and "Tigretier," the removal of the causes, the breaking up of the associations, removing persons who are young and susceptible from the performances they have such impulses to imitate, are the proper remedies.

Among the semi-civilized people of Egypt, India, and the East generally, various manifestations of similar states are frequent. The imposing rites of mystics and the peculiar exercises of religious devotees induce these conditions; and they are not unknown among the aborigines of our country. It is hoped that the cultivation and intelligence of the future will not only lead to the avoidance of these superstitious exercises, but will prevent such wide-spread epidemics of imitative and sympathetic affections as produced the ravages among the ignorant and superstitious inhabitants of the continent of Europe during the period mentioned.

The same principle of sympathy and imitation operates at the present time, and the similarity of manifestations among M. Charcot's patients at the Salpêtrière illustrates its force. Such peculiarities are at present very seldom observed elsewhere.

HYSTERIA.

Hysteria is a complex morbid condition of the cerebral and nervous functions, involving emotional, motor, and sensory changes, and presenting protean phenomena, which often imitate a variety of pathological states. No changes of structure have been discovered in the centres where disturbances exist (at least none peculiar to the disease), and hence it is classed among the functional affections.

Pathology.—Its *pathogeny* is obscure. The ancient notion that uterine disease is a necessary element in hysteria, as its name implies, is no longer tenable, since it not only occurs where no uterine affection can be discovered, but even in the male sex. It is, however, vastly more common in women than in men, and is often accompanied by derangement of their sexual systems.

Symptoms.—The first manifestations of hysteria are commonly slight.

They generally consist of emotional variability, and of what is usually spoken of as "nervousness."

There are often sudden transitions from hilarity to sadness, from laughing to weeping, without sufficient external cause. Soon, or at the same time, there may be sudden transitions of surface temperature, and still more of subjective sensations of heat and cold. Sensations of tingling or numbness, or of irritation, the locality and character of which often change, will be felt in different parts, and there will be sensations of suffocation, of palpitation, with rapid, often alternating with slow or sighing respiration, etc.

A more decided hysterical paroxysm, which is likely to follow these premonitory symptoms, consists of certain convulsive actions, a sense of choking, with efforts to swallow—a feeling as if a ball was rising to the throat (the *globus hystericus*). There is frequent urination, a large quantity of pale urine being passed; the limbs are in a condition of unrest; sobbing, and coughing with a loud ringing sound are often heard; the joints often become fixed, the fingers stiff, and violent convulsions may ensue.

There is no regularity in the character of these convulsions, though the muscles of the extremities and the trunk are more affected than those supplied by motor nerves directly from the brain. The face is seldom distorted, though the head is sometimes violently rotated. The patient often strikes her breast with quickly repeated blows, and the body is often bent backward, so that for a time the patient rests upon her heels and head.

A peculiar hysterical cry from time to time often accompanies these struggles, but quite different from what occurs in epilepsy or other severe eclampsias. Consciousness, though often obscured, is seldom entirely lost, and it is not unfrequently complete, with even abnormal acuteness of the senses.

The "fits" vary in length from a few minutes to several hours, or they may be repeated in frequent succession for some days.

With many of M. Charcot's patients several well-defined stages of the paroxysms are observed.

The convulsive movements of different kinds, and different emotional states—fear, anger, affection, etc.—follow each other in a particular order.

The spasms are sometimes tonic, but at others violently clonic, and in some cases they so much resemble epilepsy as to have received the name of *hystero-epilepsy*. Great sensibility to a slight touch is sometimes present, while in other cases or stages violent physical concussion will apparently produce no pain.

Paralysis of the bladder and retention of the urine is not an un-

frequent symptom, requiring the use of the catheter; and sometimes this method of relieving the bladder seems to be preferred by the patient to any other.

Paralysis of particular groups of muscles, or of a whole limb, or paresis of one side of the body, oftenest the left, occasionally occurs. Pain at the extremity of the coccyx, pain under the left breast, tenderness along the course of the spine, pain on the side of the head which may be covered by the ends of the fingers; illusions and hallucinations of the senses, neuralgias of every description and in every situation may be complained of, and almost every form of disease may be simulated by hysteria. Dyspeptic symptoms are common, constipation is frequent, the production of gastric and intestinal gases is sometimes great and sudden, and "phantom tumors" in the abdomen occasionally excite much alarm and annoyance.

As hysteria may occur in different conditions of the system as to its general nutrition, and as the general character of symptoms as well as their locations differ so greatly, the variety of particular phenomena is almost infinite. Cataleptic, choreic, ecstasie, trance, and somnambulistic conditions may conjoin with hysteria; and the most complicated and varied phenomena are presented.

We may have hyperæsthesias, anæsthesias, neuralgias, spasmodic contractions, more or less permanent, of the muscles of the face and eyes, of the pharynx, larynx, and œsophagus, of the vagina (vaginismus), paralysis, psychical disorders, wakefulness, sleepiness, vasomotor disorders; changes of secretion; and in fact almost every variety of abnormality may be mingled together or succeed each other in the same case.

The **Morbid Anatomy** of hysteria has not been studied by the use of the microscope and reagents in a sufficient number of cases to determine the existence of any characteristic changes, or even that any structural changes do occur. Charcot found in a woman who had been subject to hysterical convulsions since the age of fourteen, sclerosis of the lateral column of the cord, extending from the medulla oblongata to the lumbar enlargement, with partial atrophy of the anterior nerve roots; but this woman, for two years before her death, had permanent contraction of all her limbs and the muscles of the trunk; and these lesions constituted a complication rather than afforded evidence of changes belonging to hysteria.

Further investigations will be required to justify statements as to any characteristic pathological changes in the disease.

Etiology.—The causes of hysteria are various. A predisposition is often constitutional and hereditary. A hot-bed system of education may have an influence in producing peculiar nervous sus-

ceptibilities; but the grosser forms of hysteria, especially convulsions, are, according to my observation, quite as common (I must say more common) among the uneducated or those but poorly educated, as among those who have had more thorough school and social discipline.

An education which develops self-control, although it may be accompanied by influences injurious to physical health, tends to the prevention of the extravagances of hysteria.

A large proportion of cases of hysteria manifest themselves about the period of puberty. Menstruation cannot be said to produce the disease, but the disorders of this function often have that effect.

The female sex furnishes so great a proportion of cases as to favor the opinion that the uterus and its appendages are the source of the disease.

Those who consider the uterus as its only source, of course deny its existence in males.

Numerous cases have been reported of males where, according to the accounts, the symptoms could not be distinguished from typical cases of hysteria in females; but I must confess that I have not personally met with such cases. I have, however, not unfrequently seen cases in women where no morbid conditions of the uterine system could be detected.

It is much more frequent during active uterine life than before or after that period, and it must be acknowledged that in a majority of cases it is connected with some abnormal condition of sexuality.

It is more common in the unmarried than in women who are happily married, and whose affections and sexual desires are satisfied.

Hysteria is doubtless connected with morbid states of the cerebro-spinal system, but the connection of the brain and spinal cord with the sexual organs is so intimate, that it is difficult to separate the one from the other so as to determine the primary origin of morbid conditions which involve both. Hysteria is thought by some to be dependent upon nutritive derangement of the whole nervous system, producing a general morbid excitability. How much is due to increased excitability of certain nervous centres, and how much to paralysis of inhibitory functions, it is impossible to determine. There is, at any rate, a want of balance, and this is increased by various internal changes and external influences.

As an argument against the predominant influence of the sexual system, it is shown that the disease, in many cases, occurs in young persons before that system is developed; but the sexual system exists, and sexual feelings sometimes occur, at a very early period.

Well-marked cases are said to have occurred in young boys.

Rosenthal says he has seen two cases of hysteria in males, but Briquet, whose experience was very large, has not observed a single case.

Shakespeare, who when he refers to medical subjects always reflects the best professional opinions of his time, regards hysteria as possible in men; while from the use of the word "mother" in connection with it, he indicates the then prevailing opinion of its usual origin in the womb. He makes King Lear say :

"Oh how this *mother* swells up towards my heart!
Hysterica-Passio!—down, thou climbing sorrow,
Thy element's below!"

Hysteria occurs most in those of nervous irritability or excessive mobility—in those easily impressed—and its full manifestations are most in those who are weak-willed. Anxiety, disappointed love, regret, care, and jealousy tend to develop the affection in those who are predisposed to it.

Diseases of the generative apparatus, such as menstrual derangements, chronic metritis, uterine displacements, etc., tend to produce its symptoms in those of the hysterical temperament. Anæmia and neurasthenia tend to its development also, but it not unfrequently appears in its most violent form in well-nourished and even plethoric young women.

In practice several leading forms of the disease may be noticed, though intermediate varieties are innumerable.

In some forms the emotions are extreme, restlessness is marked, the conduct is eccentric, flatulence is frequent, the globus is felt, neuralgic pains and variable secretions of urine, etc., occur, but there are no convulsions. These conditions are often periodical, corresponding with menstruation. Attacks of headache succeed to the other symptoms, when the patient resumes her usual condition until another period arrives, though she is subject, under special excitement, to more speedy return of symptoms. In other cases these symptoms culminate in "fits"—in the more violent phenomena which have been described. These more severe phenomena may pass off completely in a few hours, or the patient may be left in a dreamy, semi-delirious condition, presenting more or less of the phenomena of the "mesmeric" state. Between the paroxysms various diseases are simulated. Paralytic and neuralgic symptoms, with variableness and acute sensibility, are the prevailing phenomena. The pains, in the language often used by the patient, are "horrible," "agonizing," "insufferable," etc.

In some cases the motor and reflex changes are most marked.

The voluntary acts may be sluggish, while reflex phenomena are readily excited. In these cases the convulsions are apt to appear. In the convulsive attacks there is often stupor, with perversion of the special senses, but seldom complete coma. The tongue is seldom bitten, and there is a degree of voluntary control over the spasms, as patients very seldom fall in dangerous places. Sympathy and petting seem to encourage the paroxysms and prolong their continuance.

Diagnosis.—The diagnosis is not always easy. Hysteria simulates so closely many other affections as to render in some cases great care necessary. Usually, however, the disease is recognized without difficulty. A few symptoms will often be conclusive to a clear observer who has had practical experience. During the intervals of the paroxysms the hysterical temperament can usually be recognized. The abnormal impressibility, the frequent occurrence of mental excitement, the vague neuralgic pains, the frequent sense of compression in different situations, pains or uneasy sensations in the region of the ovaries, partial paralysis, variableness in the physical feelings, the mental emotions, and the power of exertion, and frequent changes in the local circulation, will mark the constitutional state.

The *ensemble* of the symptoms during the fits will usually mark with clearness their character. Some cases will simulate epilepsy; but in the latter disease there is a symmetry or regular order of symptoms which is not in hysteria. The epileptic cry is quite distinct; and a succession of epileptic fits sometimes takes place, which is accompanied with considerable elevation of temperature, and either by delirium or apoplectic coma, and will present phenomena different from hysteria. Sometimes hysteria will simulate tetanus, but the traumatic origin of the latter, with its persistence and its serious consequences, will distinguish it. The symptoms of spinal irritation often resemble those of hysteria, and the hysterical character of many of the symptoms of the former is often apparent, so that the two conditions are commingled, their characters running into each other; but the characteristic tenderness of the spine will distinguish the “nervosisme,” as the spinal affection has been called.

Hysterical hemiplegia, more or less complete, occurring after intense excitement or from nervous exhaustion, especially if it be accompanied by loss of consciousness, may be mistaken for cerebral hemiplegia, arising from more serious brain lesions. In most cases of hysteria the paralysis is partial and consciousness is not lost; but even where the effect is more profound, the diagnosis can usually be made. In apoplectic hemiplegia the median line forms a more distinct boundary of the paralysis, the tongue deviates when protruded, the respiratory fibres of the facial nerve are involved, aphasia is

often present—conditions which do not present themselves in hysterical cases. In cerebral hemiplegia the thighs move upon the body differently, when imperfect walking is possible; in the hysterical form the thigh is dragged more like an inert mass, and not balanced from behind as in apoplectic cases, and contractures develop more rapidly in the hysterical, and other evidences of hysteria will be present.

Prognosis.—The prognosis in simple hysteria, as far as danger to life is concerned, is well known to be extremely favorable, however apparently alarming the symptoms are to the uninitiated. Complications, however, may occur, hysterical symptoms may be present in some diseases where the prognosis may be grave. In proportion, however, as the symptoms are hysterical, they are favorable.

The liability to relapses, and to a continuance of the hysterical temperament, is great. The prognosis in hysterical epilepsy, hysterical insanity, and hysterical paralysis, is more favorable than in these respective diseases not dependent upon hysteria.

Treatment of Hysteria.—This consists in the treatment of the fit, and the treatment during the interval, for the removal of the general hysterical symptoms and the prevention of the paroxysms.

During the convulsive paroxysms the restraint of the clothing should be removed, fresh cool air should be furnished, the horizontal position should be secured, and the patient kept from doing herself or others injury by the violence of her movements.

Some advise a cold douche to the head, cold cloths to the spine, the pouring of water into the face and mouth, and the application of a thorough drenching. This rough method of procedure may be applicable to some robust or vigorous patients, who may be supposed to have more control over the symptoms than they choose to exercise. Whatever the mode of its operation, it not unfrequently has the effect to check the paroxysm quite promptly. It is more likely to do so than a course of sympathetic petting. It would, however, be evidently out of place to proceed in any harsh manner with feeble and sensitive patients who do their best at self-control, and whose self-respect and respect for their attendants would be unnecessarily impaired. The management must be adapted to the conditions of each case.

Dry cups suddenly applied will sometimes arrest attention, and in this manner, and by relieving internal congestions, will check the symptoms.

Charcot has found that firm pressure over the region of the ovaries will often promptly arrest hysterical and hysterio-epileptic convulsions, and the other symptoms accompanying these paroxysms.

His rule is to press with sufficient force to feel the pulsations of the iliac artery, and to continue the pressure as long as necessary. That the arrest of the most violent convulsions often follows the application of this pressure, and that the convulsions are renewed on its removal, to be rearrested by its reapplication, I have witnessed in his wards at Salpêtrière; but how much is due to the impression upon the mind, to the expectation of such relief, and to the controlling force of the operator, and how much to the mere physical pressure of the ovaries, I am not prepared to say. M. Charcot has trusses, constructed as substitutes for the hand in producing the pressure, which appear to answer the same purpose. This mode of treatment is worthy of trial, but in order to be successful it must be thorough; indeed it is alleged that moderate pressure in this region will sometimes excite the convulsions. These facts seem to show that the generative system, of which the ovaries are the physiological centre, has much to do with the phenomena of the disease. Chloroform or ether inhaled will temporarily control the convulsions; but these articles are not often permanent in their effects, and their narcotism may be too much enjoyed to induce the patient to make strong efforts at self-control.

Bromide of ammonium, or of sodium or potassium, in decided doses will tend to relieve the central congestions and irritation, and will often promptly check the symptoms.

The bromides are particularly applicable where erotic feelings play an important part in the causation, as is sometimes the case. Morphine hypodermically or by the mouth will also often give prompt relief, and its use will be justifiable where severe pain accompanies the paroxysms. Sometimes alcohol in decided doses will have a similar effect upon the convulsions; but a frequent resort to this agent has objections which will at once be recognized.

Some advise filling the mouth with common salt; but this is in cases where disciplinary measures are deemed advisable.

Asafoetida is a common remedy, and in full doses often exerts a decided antispasmodic influence in hysterical cases. It may be given by the mouth or by enema, and when by the latter method a drachm or two of the gum properly emulsified is not too large a dose. In cases of constipation, from two to four drachms of oil of turpentine, with castor-oil, given by enema, will afford relief.

Some advise tartar emetic in full, nauseating, and emetic doses. In robust girls, and especially if there are irritating ingesta in the stomach, this is a proper remedy. It will often relieve the spasms promptly. Valerian and various other antispasmodics agree with some patients, and as palliative remedies have their uses.

The urine may be retained and the bladder largely distended, increasing the suffering and reflex convulsive actions. Where this is the case, the use of the catheter may be required, though it should be avoided if possible, and the habit of its use, when formed, should be broken up. A demoralizing effect is sometimes the result of catheterization.

But treatment during the interval and for the prevention of these outbreaks is of more importance and requires more care. Where a hereditary predisposition to hysteria exists, great pains should be taken in the education of the girl. A plain, simple mode of life, the avoidance of neurotic agents such as wines, tea, and coffee, should be insisted upon; out-door exercise should be enjoined; everything calculated to develop early sexual ideas or sexual feelings should be carefully excluded; the reading of love stories should not be allowed, and physical and mental discipline should be secured. The importance of physical, mental, and moral training cannot be exaggerated.

Physically, plain, nutritious food, out-door exercise, proper, not heating and restraining clothing, frequent bathing, large and well ventilated sleeping apartments, a hard but comfortable bed, regular and early hours, are essential. Mentally, sound and useful knowledge should be taught; school tasks should be reasonable but promptly performed; self-consciousness should be suppressed; duty rather than unreasonable inclination should be made the rule of life; and correct moral principles should be instilled. In every way vigorous womanly characteristics should be developed and cultivated, and if these are secured and local physical diseases are avoided, the hysterical temperament will be overcome. Its acquired development will certainly be prevented.

As these measures are preventive, they will also be curative where the morbid condition exists.

The special complications should always be inquired into, and the special causes traced out. Uterine affections, though not necessarily existing, may be suspected, and should be investigated with proper reserve but with care. Whatever morbid conditions are discovered should receive proper attention. Laxatives and tonics are often demanded, and the particular articles must be selected according to the conditions in each case.

The fatigued and exhausted must have rest. The methods of Dr. S. Weir Mitchell, hereafter to be more particularly described, will be appropriate to a certain class of cases. Changes of climate and scenery will often be of the greatest service. A season in the country, among the mountains, or at the sea-side, may effect great changes.

Iron, quinine, strychnia, the salts of zinc, arsenic, the bromides,

especially the bromide of ammonium or of iron, and whatever other articles the special conditions may indicate may be made use of.

Among the remedies which the general condition may require, electricity is not to be overlooked. It has its range of applicability.

There are no antihysterical specifics which are applicable to all cases.

There are some consequences of the hysterical attacks which require attention. Contractured limbs may be benefited often by hydrotherapeutic means. Sir C. Clark advises that water be poured upon them inflexibly. He also advises, when trismus is simulated, that water be poured in the face, and thinks the patient will contrive not to need it.

When hysterical conditions are communicated by sympathy, stern measures may be required to arrest the contagion. The story of Boerhaave's hot poker is well known, and its effects in arresting an epidemic of convulsions in an institution of which he had charge. Marriage may sometimes be advised, but it is not always successful.

It is sad to know and unpleasant to record that moral perversions sometimes accompany hysteria. Feigning symptoms, such as hemorrhages, coughs, paralysis, etc., introducing substances into the bladder or vagina, pretending to go without food, and various strange and unaccountable freaks are sometimes indulged in, chiefly from a morbid desire to excite sympathy or to attract attention. It is a kind of moral insanity, which may diminish but does not destroy moral responsibility, and calls for detection, exposure, and sometimes other repressive measures. A tendency to indulge in eccentric conduct, to not resist hysterical manifestations, and to exaggerate symptoms, which is observed in some cases only, has brought odium upon the disease, and produced an impression of its discreditable character. It is as real as any other functional disease of the nervous system—as real neuralgia or insanity—and by many its manifestations are resisted, and some of them successfully. Patients affected with hysteria are entitled to the same consideration as others, but for their good too much should not be made of interesting phenomena; and when a disposition to exaggeration and deception is discovered, it should meet with prompt disapproval, and, if possible, with correction. Petting and interested indulgence may lead to all the extravagances of the hysterical affection—to catalepsy, ecstasy, hysterical epilepsy, fastings, etc.

Management of the mind is important, no less as a means of cure than of prevention; and the force of mental influences is manifested in the marvelous cures of hysterical paralysis, and other like affections, sometimes produced by the laying on of hands, by charms, by infini-

tesimal doses, and by various secret but inert drugs. If in the allied condition of "mesmeric hypnotism," the subject is controlled by the will and the suggestions of another, it is not unreasonable to suppose that a similar influence can be exerted in hysteria. Indeed, this power may be made available in many diseases, and the subject of its proper exercise should receive the attention of the physician.

TETANUS.—TRISMUS.

Tetanus is a severe spinal neurosis, characterized by paroxysmal tonic contractions of voluntary muscles. It runs a rapid and generally a fatal course. The disease presents several varieties, depending upon the causes producing it. It has been divided into *traumatic* and *idiopathic* forms—the one depending upon wounds or injuries of peripheral parts, the other upon causes independent of such injuries. In the latter division are included by some writers rheumatic, hysterical, inflammatory, toxic, intermittent, and endemic tetanus, and tetanus neonatorum. In this group are some forms of disease consisting of reflex spasms due to various affections, which are different in character from the severe forms, and which possess little gravity. The tetanic symptoms accompanying hysteria are without serious results; and those produced by toxic agents, such as *nux vomica*, etc., will be grave or not according to the amount of the poison received.

The traumatic forms of the disease, and the circumstances under which they arise, are described more particularly in works on surgery; but the disease in its genuine form is much the same whatever may be its exciting cause, and its leading phenomena and pathological states, so far as understood, will now be noticed.

Symptomatology.—As a rule, the more marked paroxysms are preceded by some symptoms such as chills, feelings of oppression, stiffness of certain muscles—those of the neck and abdomen—lancinating pains starting from the wound in traumatic cases, with some difficulty of deglutition and speech.

These symptoms may last for a few days or only for a few hours, or the attack may be unheralded by these signs.

In the full onset of the disease, the muscles of the jaw are first seized with tonic spasms, which give the popular name of lockjaw. These spasms afterward, and generally soon, extend to the neck, the thorax, the abdomen, and the extremities. Many muscles are more or less rigid, and those most involved are generally very hard and firm, and the particular muscles most affected are not the same in all cases. The limbs are more often extended than flexed, and, as a

rule, in the advanced stages, the muscles of the back are more contracted than those of the anterior part of the body, presenting the condition of *opisthotonus*; though sometimes they are so evenly balanced that the body remains in a straight line. Lancinating pains often accompany these contractions, extorting cries from the sufferer. The contractions are in some cases so great as to rupture muscular fibres, and while the paroxysms continue, voluntary control of the muscles is lost. The spasms are excited by the slightest irritation, by a touch, or a breath of air, and sometimes by the mere intention to make voluntary movements.

Sensibility is varied in tetanus, generally by the occurrence of pain, but sometimes by diminished sensation.

The muscles connected with the ribs become involved, and often the respiratory movements are maintained by the diaphragm alone. Respiration becomes short and difficult, lividity follows, and death by apnoea is common. The cardiac movements are often affected also. The pulse for a time is frequent and full, but it becomes intermitting, and may be arrested by clonic cardiac spasm.

Speech and deglutition are embarrassed from an early period; during the paroxysms the mouth is dry, the tongue coated; such saliva as is secreted is viscid; there are thirst and loss of appetite, and commonly constipation. In most cases there is a moderate elevation of temperature, and in some the heat is extreme, and a miliary eruption sometimes occurs.

In the trismus of new-born infants some modifications of symptoms are observed. The symptoms often begin with contortions of the face and disorders of deglutition, commonly within five or six days after the separation of the funis, and the cases go on to a fatal termination in two or three days with symptoms of collapse.

Morbid Anatomy.—Various anatomical changes have been found in the nervous system, but not with sufficient uniformity to establish the pathology of the disease. Rokitansky found deposits in the connective tissue of the cord and centres of a semi-fluid, grayish, colloid substance, separating the columns of the cord; and in less advanced stages a semi-liquid substance strewn with small granular nuclei, with a swollen condition of nerve fibres, and with fatty granules, and colloid and amyloid corpuscles. The vessels are dilated, nuclear proliferations are found in the gray matter of the cord and medulla oblongata, and in other parts of the base of the brain.

Etiology.—A large proportion of cases of tetanus are traumatic, but its occurrence is much influenced by climate, seasons, and locality. It is more common in the torrid zone, and is endemic in certain

limited regions. Thus wounds at different periods have been followed frequently by tetanus in a portion of Long Island, and so of some other places. But the particular conditions producing the effect are not understood. In a large proportion of cases the disease follows wounds involving peripheral nerves, though injuries of nerve-centres are sometimes followed by it. Even in the cases regarded as idiopathic some internal lesion will often be found to have existed. Exposure to sudden changes of heat and cold, sleeping on the ground during a cold night after the heat of the day, and other causes of a similar character occasionally induce the disease, independent of any traumatic or other noticeable lesion. These cases, and indeed attacks from any cause, except in particular locations at special times, are rare. It is more likely to occur in complicated or penetrating wounds than in those that are simple and incised; and in wounds that have continued some time, are cicatrizing, or that have ceased to suppurate. The violence of the tetanic symptoms has no special relation to the extent of the wound, the amputation of a finger being as likely to produce the effect as that of a larger limb.

Strychnine and brucine produce tetanic symptoms—that is, they cause contractions of a tonic character increased paroxysmally; but the condition differs in its course and its effects from genuine tetanus, whether traumatic or idiopathic.

The tetanus of young infants is generally traumatic, and depends upon inflammation of the umbilicus in connection with the separation of the umbilical cord; but all cases are not produced by this, and the cause in some cases is obscure. There has been much speculation as to the nature of tetanus; but the most plausible theory is that of reflex irritation.

Diagnosis.—In making a diagnosis tetanus must be distinguished from other tonic spasms which affect the trunk and limbs, from spinal meningitis, from hysteria, catalepsy, and eclampsia, and from epilepsy and hydrophobia. A comparison of the totality of the symptoms will usually result in correct conclusions.

Prognosis.—The prognosis of genuine tetanus is very unfavorable, though patients have recovered after severe attacks. There are often, however, treacherous remissions of the symptoms; but in patients under ten years and over thirty, in previous good health, when the wound is recent and simple, the disturbances of respiration and circulation slight, and where the temperature becomes normal, a favorable result may be hoped for.

Treatment.—When we consider the numerous failures that have resulted from each of the remedies used, and the number and diverse character of the remedies that have been reported successful, we must

conclude that the influence of medicines is doubtful, or at least that their good effects are uncertain.

Surgical measures have been generally ineffectual, and amputations are not advised, unless for other reasons they are thought best. The lesion, when symptoms of the disease appear, is in the nerve-centres, or at least beyond the reach of the surgeon's knife.

Venesection has few advocates, and yet in cases of unquestionable central hyperæmia it may be of use.

Leeching and wet cups along the spine are thought by some to be useful. Ice to the spine has been praised by some, and warm baths of several hours' duration have been advised by others. Moist packs followed by cool half baths have been thought to diminish reflex excitability in the paroxysms, and anodyne liniments have been used to relieve pain.

Chloroform, ether, and chloral hydrate have been largely used, and with the effect of diminishing the suffering, but whether they tend to the removal of the disease is more doubtful, and, in excessive doses, mischief may be done by them. The narcotics have been suggested by the violence of the suffering from the earliest period, and all of them have been used, often with palliative, but very doubtful curative effects.

Aconite has been recommended by Paget and Wunderlich, commencing with five to ten drop doses of the tincture once in four or six hours, and gradually increasing as can be borne, and the authority of these names is sufficient to justify its use. It lessens the frequency of the pulse, and diminishes the frequency and severity of the convulsions.

Belladonna diminishes the rigidity of the muscles, and is more effectually given hypodermically in the form of atropine. Nicotine is found, by experiments upon frogs, to counteract the tetanic effect of strychnia, and has been used in tetanus with reported successful results. It is a powerful sedative to the heart's action, is an active heart-poison, and must be used with caution; but in proper doses it diminishes the muscular spasms and increases perspiration. Its curative action is not well established.

Opium has been used, and sometimes is tolerated in enormous doses, and it has been combined in periodical cases with large doses of quinine. When this combination is repeated until relaxation is produced, palliative effects are generally realized, and recoveries have taken place under its use. Where any malarious influence is suspected the quinine should by all means be given, and beneficial effects may be hoped for. Morphine hypodermically is the most effectual method of administering the opiate. But this mode of treatment, like the others mentioned, has so often failed that it cannot be relied upon.

Recently other remedies have come into use. The bromide of potassium, suggested by its effects in diminishing reflex action and causing contraction of the vessels of the cord and brain, has been used with reported good results. It has the advantage of being comparatively safe, and its well-known effect in diminishing other convulsive affections encourages its use. It must be given in large doses, from one to two drachms every four hours, to produce its full effects; and in the present state of our knowledge on the subject, and from the results of success as reported, it is the remedy to be preferred.

“Given early, and the effect maintained until the spasms cease, it must be regarded as the best remedy in the large proportion of cases.” (Bartholow.)

Several cases of success have been very recently reported where the bromide was given in connection with chloral hydrate, both in enormous and long-continued quantities.

Bernard and others have shown that curare diminishes the irritation of the cord and the motor nerve trunks, though it does not affect the direct excitability of the muscles. It has since been used in tetanus, and with reported good results. It is given hypodermically, and as the article is uncertain in its composition and strength, the exact dose required can only be determined by observing the effects. It will be prudent to begin with from one eighth to one fourth of a grain, to be repeated until some effect upon the spasms is produced.

Physostigma and eserine are comparatively new remedies, but they have been given in a sufficient number of cases with reported good results to inspire some confidence in their use. Eserine is given subcutaneously in doses of one sixtieth ($\frac{1}{60}$) of a grain, this being increased gradually and its effects watched until the spasms are checked. Cannabis Indica is another reputedly successful remedy, and may be worthy of further trial. But it must be confessed that all these remedies fail too often, to inspire great confidence in any.

Electricity has been used in this as in almost every other form of nervous disease; but neither on rational principles nor as the result of experience can much be said in its favor.

As there are no specifics, rational indications should not be neglected. In traumatic cases, if anything can be done to diminish the irritation of the wound, it should receive attention. In the beginning of the symptoms the condition of the bowels should be inquired into, and an active cathartic may be of decided service. A case is remembered in my early practice where decided symptoms of tetanus followed a punctured wound from a nail which passed nearly through the foot of a lad, and where the action of a brisk cathartic of calomel, jalap, and cream of tartar, seemed to remove all the tetanic symptoms.

Two or three Dover's powders after the cathartic, with a poultice to the foot, were followed by complete recovery without further unpleasant phenomena. I will not say the patient was cured by the treatment, but he got well. This is as much as can be said of any of the remedies which have been mentioned.

The patient should be properly fed, and protected from noises, excitements, and annoying influences of every kind, his bowels should be kept open, and his strength, as far as possible, should be sustained.

Cases have very recently been reported as successfully treated by strict *isolation*, separating the patient from friends and relations, removing possible sources of sensory disturbance, and administering small doses of morphine or chloral, adding in one case one sixteenth of a grain of atropine with the chloral.

HYDROPHOBIA.—RABIES.—CANINE MADNESS.

Hydrophobia is a specific cerebro-spinal neurosis, produced by a contagious poison, commonly communicated in the saliva of rabid animals, particularly the dog; and it is characterized by spasms of the throat when attempts are made to swallow liquids, or even by the sight of water or a shining surface suggestive of water, by pain and stiffness in the inoculated part, and by delirium, commonly paroxysmal, and soon by exhaustion and death.

The sole *cause* of genuine hydrophobia in the human subject is inoculation with the specific poison which is generated in animals affected with the disease.

The disease is oftenest found in dogs, wolves, foxes, and cats, and must occasionally at least arise in them spontaneously; and the various domestic animals, when bitten and inoculated from them, are subject to the disease.

The period of incubation in man, after the poison has been introduced, varies greatly. It generally ranges from twenty to sixty days, but may exceed these limits in either direction, and occasionally cases are reported where many months, and even years, have elapsed between the introduction of the poison and the occurrence of the disease.

Symptoms.—The full outbreak of the severe symptoms is usually preceded by prodromata, consisting of chills, malaise, aversion to fluids, some difficulty of swallowing and breathing, pain and irritation at the seat of the bite, often radiating along the nerve trunks, and at length muscular contractions in the limbs, and disturbance of the mind. The duration of these symptoms is from one to four days, when the full onset of the developed disease occurs, and in some cases

the prodromata are unnoticed. Among the first violent symptoms is an intense spasm of the pharynx, with much difficulty of breathing from spasm of the respiratory muscles and the larynx, these phenomena being more or less paroxysmal in character. These symptoms continue and increase. At intervals, by closing the eyes or taking the fluid from an opaque vessel, some may be rapidly swallowed. Any sights or sounds that suggest water will, as the symptoms progress, excite the spasms; but often a warm bath will be tolerated, as that may not suggest the idea of drinking.

Slight currents of air or shining objects may excite spasms. There is generally great precipitancy of movements, and sometimes great loquacity is displayed.

In some cases the generative organs are in a high state of excitement, producing satyriasis or nymphomania. In children some form of insanity is said to be manifested, with hyperæsthesia but without marked tetanic convulsions.

The face is pale or livid, the expression much altered, the eyes fixed and glassy, though sometimes they roll in the orbits; and the muscles of the face, jaw, neck, and trunk, and sometimes the limbs, are affected with tonic spasms. Pain is experienced in different parts, and the mind at intervals is sufficiently clear to apprehend the danger—to fully realize the severity of the suffering, and to beg for relief by speedy death. Consciousness is sometimes preserved to the last, though delirium and even maniacal conditions are often present; and, in some cases, attempts at biting are made. The pulse is usually frequent and small from the first, and more so as the disease advances. The digestive apparatus is less affected, though the appetite is lost and the thirst is great. The saliva, which is seldom swallowed, is frothy and tenacious; and at an early period after the bite pustules are said to have been found upon the sides of the frænum of the tongue. As the disease approaches its fatal termination, the symptoms increase in severity. There is extreme agitation, generally continual expectoration; bluish spots appear on the surface, which is bathed in sweat; vomiting of frothy bloody matter often occurs, and the pulse failing, the patient dies suddenly in a convulsion; or tossing about in an unconscious state soon becomes exhausted, and the terrible struggle is over. In some cases a deceptive calm takes place a few hours before death, and the patient may even be able to take drink, but the symptoms return with a certainty, a knowledge of which excludes hope.

Morbid Anatomy.—Hyperæmia of the brain has been found, with dark coloration of the cortical substance, and points of softening in the optic thalamus and corpus striatum, extreme vascularity

of the medulla oblongata, congestion of the spinal membranes and the substance of the cord, with partial softening; and in some cases there is injection of the sympathetic and phrenic nerves, and of the cerebral branches of the pneumogastric. The nerves coming from the part bitten have sometimes been found of a reddish color. The respiratory apparatus is generally extremely congested, the papillæ of the tongue and pharynx are sometimes projected in an extreme degree, and occasionally small bullæ are found under the tongue.

On microscopical examination various changes have been found in the nerve elements of the cord and brain, such as proliferation of the adventitia, amyloid degenerations, destruction of axis cylinders, vacuoles, colloid deposits, molecular destructive changes, and small hemorrhagic points. Whether these changes are primary and essential to the disease, or secondary or accidental, has not yet been determined. Some changes have been found in the blood, but a sufficient number of examinations have not been made to justify positive general conclusions.

The essential nature of the disease, beyond the fact of its production by a peculiar specific poison, which operates with greater or less rapidity, according to the susceptibility of the patient, is not known.

The facts of its phenomena have been mentioned, and they comprise the sum of our knowledge on the subject.

Diagnosis.—This is not difficult as a rule. The fact of the previous bite, the peculiarity of the symptoms, and the rapid course the disease pursues, are characteristic. Imaginary hydrophobia, the result of fear, will be readily distinguished, and requires only moral treatment; and the aversion to fluids and difficulty of swallowing which sometimes occur in other diseases, such as hysteria, cerebral affections, typhoid fevers, etc., will be distinguished by the accompanying symptoms.

The **Prognosis** of an unequivocal case of the developed disease is almost as unfavorable as possible. Death must be looked for as the almost certain result. The prognosis, however, in the cases of those reputed to have been bitten by a mad dog, or who have actually been bitten by one, is quite different. A large proportion thus bitten never take the disease. Either they are not inoculated by the virus contained in the saliva of the dog, the teeth being wiped off by the clothing, or the saliva being otherwise prevented from entering the wound in sufficient quantity, or they are not susceptible to its influence. Animals supposed to be rabid are not always so. They are often killed before the question of their disease is determined. From these uncertainties various remedies as preventives have obtained a

reputation, notably the "mad-dog stone," which is held in great repute by some superstitious persons.

Nothing can be relied upon as a prevention but a speedy and free incision or cauterization of the wounded part.

Treatment.—The principal treatment is prophylactic and surgical. Cleansing the wound and extirpating the parts about it, or cauterizing it with a hot iron or caustic potash, are to be advised. The wound thus treated should be kept open and induced to suppurate for six weeks or more, by some irritating application. In a case of reported recovery, the wound reopened and spontaneously suppurated, and this suggests the propriety of inducing suppuration when cicatrization has taken place and symptoms of the disease appear.

When the disease has made an attack, drawing blood and supplying its place by transfusion has been suggested. But this is a theoretical suggestion rather than a conclusion from experience. The same may be said as to the curative tendencies of all other remedies. The warm bath is said to have calmed the symptoms, and the continuous use of electricity for some days—the poles being applied to the soles of the feet and to the forehead—is reported to have kept the convulsions in abeyance, but the patient died of exhaustion all the same.

A case of cure by the use of curare has, however, been reported. This article was given in two doses of one third of a grain at an interval of fifteen minutes, and an hour after the last nearly half of a grain was given—the latter repeated twice after an interval of an hour, and once after an interval of an hour and thirty minutes, and once more after an interval of two hours and twenty minutes. The hydrophobic symptoms ceased, but paralysis of the limbs replaced them and continued for two months. One case is not sufficient to establish a principle in therapeutics, and certainly this case is not sufficient to establish the curative effect of curare, if for no other reason, from the possibility of an error in diagnosis.

However, in a disease so desperate, a remedy which affords even the least hope of success may be tried.

WRITER'S CRAMP.—ARTISAN'S NEUROSIS.—SPASM OF THE HAND WITH INCOÖRDINATION OF MOVEMENTS.

This is a spasmodic affection, with a failure in the use of certain muscles of the hand engaged in the performance of delicate manipulations.

It is more frequent in persons engaged in writing than in others,

and hence the name writer's cramp; but it may occur with others, such as those engaged in knitting, sewing, drawing, engraving, performing on the violin or piano, counting money, etc. Besides a spasmodic contraction of the muscles there is often a failure of their power, and always a failure of proper coördination of action.

The parts supplied by the median nerve suffer most, as a rule, but those supplied by the radial and ulnar nerves do not escape.

Symptoms.—This disease comes on gradually, and is chronic in its course. At first a disagreeable sense of tension is felt after the use of the muscles for long periods. As it increases, tremors occur and a severe sense of fatigue in the hand and fingers is felt. The act of writing, or whatever other manipulation is performed, becomes difficult, and in severe cases impossible. Special efforts to perform the acts often increase the difficulty, and more decided spasms and greater weakness result. Pain is now experienced, and the muscles not only of the fingers but of the forearm, the arm, and shoulder, are often more or less affected. With some there are painful points along the course of the nerves, with tenderness on pressure, and changes in electrical excitability.

Etiology.—The cause of this affection is excessive use of the muscles in the manipulations, but much is due to predisposition and to the general state of the nervous system. Stimulation by the faradic current may produce temporarily the symptoms of the affection, and this would seem to indicate that irritation as well as exhaustion constituted the initial cause of the affection.

Diagnosis.—The diagnosis is not difficult when a careful observation of the particular local symptoms is made, and the cause which has produced it is considered. It is to be distinguished from loss of power in the hands from central disease, and from lesions in the course of the nerves; from hysteria, from progressive muscular atrophy, etc., by the symptoms which are characteristic of these affections.

Prognosis.—The prognosis in the milder forms, which occur with anæmia, dyspepsia, and temporary overfatigue, is more favorable; but in the severer forms much time will be required to produce material improvement, and some cases offer little or no hope of recovery.

Treatment.—Preventive measures may be found in the use of a large pen-holder, or an elastic pen, and in an easy manner of holding and using the instrument.

As soon as symptoms appear, the work which has caused the difficulty must be laid aside for six months or more. If this is done, and the general health is improved, a cure may be hoped for. Various particular remedies have been prescribed, such as preparations of

zinc, of iron, and of arsenic, and these and various other means may be useful for improving the general condition and strengthening the nervous system. Change of air and scenery will often be of service, and hydrotherapeutic measures may be useful. In short, whatever remedies will improve the general condition are indicated. The special measures for the improvement of the local symptoms are electricity and massage.

The constant galvanic current is thought to be preferable. A stable current of moderate intensity may be passed through the upper part of the vertebral column, or from the spine to the brachial plexus, and then to the affected nerves and muscles; the *séance* being from three to five minutes. Other particular methods of using the electricity are practiced. The muscles of the forearm, the thumb, and the fingers should be gently rubbed and kneaded before applying the electricity, and at other times also. But whatever other means are used, *rest from the accustomed work is essential*.

ESSENTIAL SPASMS OF THE EXTREMITIES.

There are other spasmodic affections of the extremities which do not correspond with any of those that have been mentioned. Jaccoud describes a variety occurring mostly in persons from eighteen to twenty-five, and in children from one to three, which he calls *essential or idiopathic spasms of the extremities*. It sometimes follows fevers and other diseases, and in children is connected with dentition, intestinal worms, and with various gastric and intestinal diseases. The flexors of the upper extremities are more liable to be affected, though other muscles are often involved. The duration is from a few days to a few weeks, and relapses are likely to occur. Paralysis sometimes follows the cramps, and in rare cases the muscles of respiration are to some extent involved. In most cases, however, the spasms are confined to the extremities, and the affection tends to a favorable termination.

In the *treatment* the pathological conditions that give rise to the state should receive the principal attention. Eliminatives, anti-periodics, and sometimes tonics, may be required. Anodynes for allaying the pain which often accompanies the contractions may be indicated. Anodyne frictions often give relief.

STUTTERING.—STAMMERING.

Stuttering consists in an imperfect control of the muscles of articulation. There is a defect in the coördination of the vocal movements,

allying the affection to writer's cramp on the one hand, and to chorea on the other.

Its phenomena are too well known to require a particular description. It has different degrees of severity, and each case has its peculiarities.

There are three centres for the production, or articulation rather, of sound—the anterior, middle, and posterior. The anterior is narrowed or closed by the motions of the lips, or of the lower lip in its relations to the front teeth. The consonants that are called labials are produced by these motions. P, b, f, v, and m are thus produced. The middle space is bounded by the upper incisor teeth and the anterior part of the vault of the palate, and is occluded or narrowed by the motion of the anterior part of the tongue. T, d, l, and n are thus expressed. The posterior space is the posterior palatine vault, and is closed by the motions of the back part of the tongue.

The sounds of k, g, ch, and j are formed here. In pronouncing the letter r, in its connections, the action of all these parts is concerned.

In some cases of stuttering the motion of the lips is most affected. There is a labial choreic motion. In other cases there is more spasmodic rigidity in the pharynx and larynx, and an interference with the utterance of the sounds produced in the posterior and middle space occurs. In these cases there is a tetanic condition of the parts concerned. In most cases of severe stuttering there is both a labio-choreic and a gutturo-tetanic condition, and the results in speech are exceedingly annoying to the patient.

Etiology.—The cause of this affection is a peculiarity of constitutional condition, sometimes hereditary; and the infirmity may be developed by fright, anger, or embarrassment, in those constitutionally predisposed to it.

The nervous centre most concerned in the mechanism of phonation is in the medulla oblongata, and the chief defect is doubtless there.

A distinction is made between stuttering and stammering. The latter is said to consist more “of a difficulty in performing the movements requisite for the articulation of certain consonants, phonation remaining intact. It is never accompanied by spasmodic or congestive phenomena, or by difficulty of respiration.”

Stammering is not so serious an affection. Stuttering sometimes occurs in connection with other cerebral affections, but when not thus associated it portends no danger.

Prognosis.—The prognosis as to recovery is not unfavorable in young subjects in good health, when the affection is of the slighter forms and largely produced by excitement and embarrassment. In

such cases the defect often disappears spontaneously at a more advanced age.

Severe and chronic cases are often incurable, and even when there is improvement under treatment relapses are apt to occur.

Treatment.—As to treatment, no specifics, medical or surgical, are of avail beyond those which may improve the general health and strength.

Systems of vocal gymnastics have succeeded in some cases, while all measures have failed in others.

The regulation of the precipitate and unrhythmical forms of respiration is a principal object, and systematic speaking must be taught. Many who have great difficulty in conversing can sing or speak in a formal manner without hesitation.

Full inspirations are advised to be taken before beginning to speak. The enunciation should then be in syllables and in musical or measured time, the trainer beating the time; and after, in practice, the patient should accompany his measured speech with the movements of his own hand.

It is advised that each phrase be scanned like a word of several syllables, slowly and with distinct intonations, and that each syllable should have an equal duration. Full inspirations should be taken at each pause in the utterance of a phrase, but without interrupting the rhythm of the pronunciation. Attention should be called to each wrong movement of the organs, and a special effort made to correct it. By cultivating this regular method, the organs in many cases may be trained to regular action, and the bad habit, if not too long continued and too firmly fixed, may be overcome.

Long-continued and careful practice is important to avoid relapses, and under embarrassment or excitement the difficulty is apt to be manifested.

The management of cases is usually confined to specialists, but every physician should understand the general principles concerned, and should advise those under his care to seek relief in time.

Months, and even years of practice may be necessary to effect a cure, and perpetual care in speaking may be required.

TOXIC DISEASES OF THE NERVOUS SYSTEM.

Many morbid conditions, the result of poisonous materials taken in from without, or developed within the body, have already been discussed. Indeed, a large and exceedingly important part of the diseases to which we are liable are produced by material poisons.

There is, however, a class of cases where poisons expend their forces chiefly upon the nervous system, that requires further mention. The effect of toxic agents which produce paralysis has been spoken of, but there are other effects on the brain and nerves of much interest and importance. Most of the poisonous narcotic agents *diminish power* as their chief effect, and all derange nervous action.

Some act principally on the brain. This is the case with the pure narcotics. Opium, alcohol, ether, chloroform, tobacco, tea, and coffee affect most the cerebral functions. Other narcotic articles affect more the spinal marrow and the nerves. Among these are strychnine, woorali, conium, and picrotoxin. Others, as hydrocyanic acid, produce cerebro-spinal diseases. Others still, as lead and mercury, affect the neural and neuro-spinal functions. Others affect special organs and functions, some producing much more effect under some circumstances than others. Thus ergot affects the uterus in labor, stramonium the bronchi in particular conditions, veratrum viride, aconite, and digitalis affect specially the heart, etc. There are antagonisms between the operations of various agents, and between particular agents and particular diseases, which it is very important to understand, and to which professional attention is being directed.

These peculiar effects are ultimate facts, which are to be observed and made useful, but which are for the most part incapable of explanation.

The full description of these poisons, their symptoms, detection, and antidotes, belongs to toxicology and materia medica; but the special diseases induced by them come into the department of pathology and practice of medicine.

The poison of *lead*, in its production of colic, paralysis, and anæmia, has been treated of. It produces a variety of nervous symptoms in addition to, and sometimes independent of, those more marked phenomena. Arthralgia—a form of neuralgic pain—muscular weakness, mental confusion, difficulty of speech, menstrual disorders, and frequent abortions in females; delirium, convulsive attacks, anæsthesia, and amaurosis, as well as colic and lead palsy, may be produced.

The *treatment* of lead poisoning has been mentioned, and the same general plan is required for the more rare as for the more common symptoms. The eliminative effect of iodide of potassium must be aided by warm baths, and after a time vapor baths, and often by tonics; and the good effects of electricity, which are marked in lead poisoning, may be promoted by the same means.

Various nervous symptoms—tremors, neuralgic pains, affections of the special senses, vertigo, insomnia, hypochondria, epileptiform

attacks—and rarely mental failure may result from long-continued *mercurial* poisoning. The elimination which iodide of potassium effects may be increased by means similar to those advised in cases of lead poisoning.

In chronic arsenical poisoning, tremors, atrophy, and paralysis of different muscles may result, and changes of sensation with cephalic symptoms may occur, for which eliminatives and faradization are advised.

Carbolic oxide, sulphide of carbon, aniline, and phosphorus have each some peculiarity of poisonous effects, requiring symptomatic treatment on general principles.

The nervous disorders resulting from the poison of fevers, diphtheria, etc., have been referred to in connection with these affections, and need not be further dwelt upon.

ALCOHOLIC POISONING.—ALCOHOLISM.—ALCOHOLISMUS.

By far the most disastrous and frequent form of poisoning in all our communities is that arising from the use (most writers say abuse) of alcohol. “The toxical condition called alcoholism,” says Prof. Flint, “enters directly into the constitution of many affections, such as cirrhoses of the liver, fatty liver, epilepsy, muscular tremors, gastritis, pyrosis, and various dyspeptic disorders. Indirectly, alcoholism favors the production of nearly all diseases by lessening the power of resisting their causes, and it contributes to their fatality by impairing the ability to tolerate or overcome them.”

An article deliberately used by millions (instead of a few being accidentally exposed to its influence, as is the case with most of the other poisons which have been named), respecting which the words of Prof. Flint are so truthfully pronounced, deserves to have its properties, its effects, and the propriety of its use carefully examined.

The many allusions which have been made in the preceding part of this work have indicated the general opinions which the writer entertains respecting this article, and render unnecessary as full statements in this place as the importance of the subject would otherwise demand.

Its particular effects in producing neuropathic diseases will require to be mentioned, and the special nervous diseases it induces will demand attention.

Alcoholism, or the injurious effects of alcohol on the system, may be *acute*, *subacute*, or *chronic*.

Among the acute injurious effects are the immediate consequences of a few doses upon the body and the mind, so familiarly known as drunkenness ; and less frequent are delirium ebriosum and alcoholic eclampsia. Among what may be termed the subacute affections produced by it are the states preceding and embracing *delirium tremens*, acute *mania*, and acute *melancholia*. Among the chronic effects are various degenerations of the stomach, liver, kidneys, lungs, and the peripheral organs of the body, insanity, epilepsy, tremors, and particularly *Dipsomania* or *Oinomania*, or, as it is sometimes called, *Inebriety*—a craving for alcoholic or other narcotic substances.

The almost universal opinion formerly was, and to no limited extent still is, that the essential action of alcohol is stimulating—that its effect is to increase action ; and when action is evidently suspended by it, the suspension is attributed to *overstimulation*. The debility of organs, or of the whole system, which so certainly follows where much is taken, has been regarded as the recoil from overaction.

By those entertaining these views, delirium tremens was regarded as the result of withdrawing the stimulant.

Dr. Ware, of Boston, fifty years ago, showed that this effect of alcohol (delirium tremens) very often came on in the midst of indulgence, and that the stopping of the use of the accustomed alcohol, which was supposed to be the cause of the disease, was the result of its approach. More recently the writings of Anstie, of Richardson, and others have thrown great doubt upon, if they have not positively disproved, the doctrine of the essentially stimulating effect of this article. In delirium tremens—hallucinations and maniacal excitement—a *disease* of the nervous system has been produced, and the phenomena are not the simple result of withholding the article which has caused the disease ; nor can these symptoms of the cerebral disease be regarded as the immediate action of alcohol on the nervous tissues.

The symptoms are different from those produced by alcohol upon the conditions of a comparatively healthy brain. They occur only where the brain cells have become diseased from the continued use of alcohol.

It is not denied that certain phenomena, indicative of a kind of increased action, are often the result of alcohol ; and especially so in some abnormal or diseased conditions. Even in health the pulse often rises in frequency, and sometimes, though not generally, in force, from what is called a stimulating dose of alcohol.

The same is often true of ether or chloroform in moderate doses, and of opium or the other narcotics ; but these effects are as likely to be the result of paralysis of inhibitory functions as of the excitement of the active ones.

There is always in the use of alcohol evidence of the disturbance of that balance which produces the most normal action. The cause of a fever often produces increase of the pulse, both in frequency and force, and so does the existence of various palpable injuries, which by no means can be regarded as simple stimulants.

Increased action is often the result of an effort of the system to resist an irritating, but really depressing agent.

Alcohol often produces dilatation of the carotid and cerebral arteries, causing more blood to flow to the brain. This may increase certain activities for the time in that organ, but this increase is the result of diminished tonicities in the vessels, and this in turn indicates paralysis of the vaso-motor nerves.

An intoxicating quantity of alcohol (which means a poisonous quantity) at first increases the blood flow through the brain, and causes certain movements there to be more active. "The thoughts flow rapidly, the halting speech loosens into eloquence; coldness of feeling gives way to affection, passion, or sentiment; despair becomes blended with hope, courage is reanimated; difficulties melt away, and the impracticable is almost (in imagination) realized. These are the sensations which have impelled men in every clime to devise some means of exalting (apparently) the nervous life; and a fearful price is paid for it. Soon the ready speech grows muffled, the thought is confused, the impressions blurred; the higher feelings become submerged under the rising animal impulses; hope becomes disfiguring conceit, courage merges into recklessness and boasting, exhilaration into boisterousness, and sentiment into maudlin. At last the human frame lies unconscious, powerless, all is oblivion; the awakening is however a grave reality."

This picture, so graphically drawn by Fothergill in his *Handbook of Treatment* (pp. 225-6), presents to my mind the phenomena, in every stage, of the failure of power. At first the vaso-motor nerves of the carotid and cerebral arteries are paralyzed. The restraining, regulating, inhibitory functions are diminished or suspended; the balance-wheel of feeling and expression is upset, the regulating pendulum is removed, and the machinery of thought and action flies on, not from an increase of force applied, but from a diminution of regulating power; and then all force is so much diminished that the body and mind lie powerless, not from a stimulating but a depressing agent. The power that can be accurately measured—that of the voluntary muscles—is diminished from the beginning. The tipsy man may feel strong and boast of strength, while his limbs are feeble, and at length are unable to sustain him. These are the unquestionable effects of free alcoholic doses, and the long-continued

action of less extreme quantities causes chronic poisoning, in which loss of power is a marked condition. In delirium tremens, debility, exhaustion, loss of power is the unquestionable state, and yet rapid ideation, intensity of emotion, and intensity of certain actions are conspicuous. Stimulation is not the proper word to be unqualifiedly applied to the action of alcohol. Neither in health nor disease is it a simple stimulant. It is a *narcotic*, and must be classed with other narcotics. It often, by its influence on the nervous system, allays suffering, physical and mental, diminishes shock, and produces agreeable sensations; and these are among the effects of narcotics—of opium, chloral, and even tobacco—especially in those accustomed to their use. The latter article certainly cannot be regarded as a stimulant, and yet it may increase some actions in those who have long used this essentially sedative agent. When such persons are deprived of the accustomed quantity depression occurs, and when they return to it increased activity is restored. Alcohol, like opium, will often relieve a sense of fatigue and induce action without increasing power. But its pathological effects in producing diseases of the nervous system are to be considered here, rather than its physiological or therapeutical action. When taken in such quantities that its effects are more distinctly marked, it diminishes sensibility and muscular power, the spinal and the fifth cerebral nerves being first affected, and the lower limbs being deprived of power sooner than the upper.

The vaso-motor nerves of the surface are soon diminished in their tonic action, so that the face is flushed, the conjunctivæ are congested, there are cerebral and intellectual disturbances, confusion of ideas, loss of a sense of propriety, indifference to the feelings and claims of others, and the moral effect of inebriation is produced. As the quantity is increased, motion, sensation, respiration, and the heart's action diminish, and at last all cease.

The readiness and completeness of absorption of the alcohol vary with the amount of food and liquid in the system.

When alcohol is taken fasting, the effect is more speedy and severe than when taken with much food and water.

There is a great difference in different persons in the rapidity with which alcohol is eliminated from the system. The more speedily it passes off from the skin, in the breath, and by the kidneys, the better when a given quantity has been taken.

The weight of testimony is to the effect that about one ounce and a half is capable of being oxidized in the system in twenty-four hours, and if this is the case, it acts in a certain sense as a food; but its food properties are quite *insignificant* as compared to its

neurotic action. Though to a limited extent it may be oxidized itself, it commonly diminishes by its narcotic action oxidation in the system, and in that manner, as a rule, it diminishes rather than increases force. By diminishing oxidation it lowers temperature, and by relaxing superficial vessels and bringing the blood to the surface, it favors the escape of its heat and diminishes the resistance to external cold. By its narcotic effect it may diminish the sense of cold while favoring the reduction of temperature. Death from cold takes place much sooner under its influence.

These are the ordinary immediate morbid effects of alcoholic poisoning, which are too familiar to need further description.

Drunkenness, the immediate and usual effect of a large dose of alcohol, need not be more particularly described. When carried to the extent of producing an unconscious state in a full-grown, vigorous person, the alcohol will in time be eliminated and the patient will generally recover. In very young subjects there is more danger, and *treatment* is sometimes demanded.

Evacuating the stomach and bowels of the alcohol within them is the first object. A prompt emetic of salt and mustard, or the sulphate of zinc, or the use of the stomach-pump, should be resorted to. Cold affusions—cold water poured from some height upon the head—or galvanism or electricity may be used. Sinapisms may be applied, with external heat to the extremities when the temperature is very low. Acetate of ammonia is often prescribed in free doses; and later, to soothe irritation, the bromides may be given.

ACUTE ALCOHOLIC DISEASES.

Delirium ebriosum is a delirious state, produced by alcohol, but different from the ordinary phenomena of drunkenness. It is spoken of as “crazy drunkenness.” The patient (for so he must now be considered) is raving, often pugnacious, and has usually sufficient muscular strength to be violent and aggressive. There is a state of cerebral irritation.

The face is usually flushed, though it is sometimes pale. The eyes are injected, the head is commonly hot. He often screams and curses, though he may pray; and these states may alternate in quick succession. This condition is comparatively rare, but I have seen several cases that occurred in the harvest field, where heat and exertion contributed to the result. It occasionally occurs without these concomitant conditions. The symptoms subside as the liquor is eliminated. The pathological condition appears to be hyperæmia of the brain, combined with the direct irritating effect of the alcohol upon

the brain tissue. It is the result of excessive drinking of short duration, rather than of the protracted use of the poison.

The *treatment* is simple. If the patient is seen before the liquor is all absorbed from the stomach, an emetic should be given, and the stomach well washed out with water. When the head is hot, cold should be applied; bromide of potassium may be given; and if there is great violence the patient may be quieted by the inhalation of chloroform or ether. In cases of plethora, and where evidences of congestion are marked, a venesection or the application of cups may be required.

ACUTE ALCOHOLIC ECLAMPSIA.

This is comparatively rare; but I have known a few cases where intoxication usually produced violent convulsions. These are clonic and semitonic, repeated at longer or shorter intervals, generally with coma between them. The pulse is variable. It is sometimes much depressed, and the respiration is often slow, and at times suspended, threatening more complete arrest of the functions of the heart and lungs.

Death in this condition has sometimes taken place, but this result I have never witnessed. The convulsions cease with the elimination of the alcohol.

The *treatment* should be similar to that of the preceding disease, delirium ebriosum. An emetic should be given if the patient is seen before the alcohol has all left the stomach, chloroform may be administered to control the convulsions, but should be used with caution, particularly where the respiration and the heart's action are feeble; and ammonia is indicated where the depression is marked. Bromide of potassium is also indicated where the symptoms are at all protracted.

Convulsions of a different character, epileptiform and more persistent, from the protracted use of alcohol, are far more dangerous. I have had in my care one case in a distinguished professional gentleman who had so modified the effect of alcohol, which was taken in much excess, by opium in very large doses, that the phenomena of drunkenness were seldom manifested. He was able, notwithstanding his excesses, to continue his business until he was attacked in the street with convulsions of a severe epileptiform character, which were repeated once in a few hours, with very imperfect recovery of consciousness between them. These convulsions continued about two weeks, and terminated in death. A post-mortem examination revealed no inflammatory or material hyperæmic condition of the brain or other organs.

This was many years ago, and no microscopical examination was made, and no molecular changes were detected. To the naked eye the brain appeared healthy, and was remarkable in its cortical development. The combined effect of the alcohol and opium had, however, so changed the activity of the brain, and doubtless by changing its ultimate structure, as to result in these formidable and fatal convulsions defying all remedies.

DELIRIUM TREMENS.—MANIA A POTU.

Delirium tremens is a peculiar disease of the nervous system, produced by the somewhat protracted use of alcohol, characterized by emotions of fear and horror, by hallucinations and delusions of vision and other senses, by muscular tremors, and by prostration of the general powers.

Phenomena.—Two somewhat distinctive stages of the affection may be recognized. In the first stage, continuing for a day or two, and sometimes longer, the pulse may be slow and feeble, there is mental anxiety, with restlessness and vague apprehensions. There will be hallucinations for a time, the reason recognizing the imagined objects as unreal, but their persistent return inducing a half belief in their reality. The patient is fidgety, and troubled about business. He fears ruin, and perhaps speaks of plotting enemies. He is sleepless, or rises several times in the night, apprehending burglars or some approaching evil. His hand has an unsteady grasp. The face is sometimes flushed and eyes injected, though if his drink has for some days been discontinued the face is rather pale and the skin is moist, often bathed in perspiration. He is often looking about him, or listening as to distant sounds. He, however, answers questions properly, and shows, when requested, a trembling, coated, though moist tongue. His pulse is soft and feeble. Soon more positive hallucinations appear, and then more decided delirium, which ushers in the severer stage.

There are now delusions, incoherence of thought and language, wild excitement, with fear predominating. There may be anger, but it is accompanied with fear. The patient can usually, however, be restrained for a while by a firm manner, and he is seldom aggressive except in what he regards as self-defense.

His pulse is now from 100 to 140, and is variable in fullness and force, but usually it is soft and weak, and often dicrotous. The tremors are increased, there are profuse sweating, great restlessness, and extreme delusions, with feebleness of the cutaneous circulation; the

temporal arteries may throb and the face be flushed, but it is often pale. The tongue may be pale and moist, or dry and red. His appetite for days has been feeble or lost, and it may be with much difficulty that he can be induced to take food.

In this state he is pursued by serpents, by monsters, or devils, and cries out in mortal fear. He is tormented by visions and sensations of snakes twining about him, of vampires flapping their skinny wings in his face, of worms and bugs crawling upon him, or possibly of instruments boring into his brain.

He fears his friends, and often endeavors to escape, and if successful may spring through a window and run screaming through the streets. Even in this condition his weakness, physical and mental, often makes him controllable by a firm manner with but little physical force. This condition lasts from one to three days. The patient may then sleep, and a general improvement may take place; or the pulse may continue feeble and rapid, the tongue become dry, and convulsions or coma may supervene, ending in death. If the delusions cease, and consciousness is retained, sleep becomes restful, food is taken, and convalescence follows.

Etiology.—The patient with delirium tremens as described has been an habitual hard drinker, though he may never have been drunk. He is perhaps more likely to have been upon a protracted spree, and has been drinking much and eating little up to the time of the violent symptoms, or upon their approach. On the occurrence of the “horrors” he may have ceased to drink, or have taken but little while his disease has been developing. He may have been picked up in a state of unconsciousness in the street, and as the immediate effect of the liquor passed off, these symptoms came on. Or he may have been found in a drinking saloon, where he had become furious—at times aggressive—but soon terrified, the direct effect of the alcohol and that of the disease it has induced alternating in their manifestations. In this state the face is flushed, the skin more dry, the hands and tongue are tremulous, but not extremely so, and the latter is usually reddish; the pulse soft, but not very feeble. In such cases drinking has been excessive up to the time of the development of the disease. In some cases an attack of disease (a pneumonia) or a traumatic injury (a fracture) occurs in a hard drinker, and the effects of the disease or injury, added to those of the alcoholic state, speedily develop the affection. These complications are usually very serious.

Pathology.—The *morbid anatomy* of delirium tremens is not well defined. The post-mortem appearances of the central nervous organs in those dying of the disease, unless other symptoms of alcoholism have appeared, are not striking, and none have been discovered

with sufficient frequency to be regarded as characteristic of the affection.

There is, however, said to be more or less congestion of the brain and upper part of the spinal cord, and sometimes deposits of refractive granules and hæmatodin crystals in the walls of the small vessels. But inflammation does not occur, nor is hyperæmia an essential element. There is usually some increase of the cerebrospinal fluid, the ventricles of the brain sometimes contain an excess of serum, and the substance of the brain may be œdematous. The most that can be said is, that there is a condition of irritation, with a functional change peculiar to the free use of alcohol. Molecular and chemical changes are probable, but specific characters have not been demonstrated.

All cases of delirium tremens are not typical. Some are mild, not passing beyond the first stage, and decided delirium does not occur. If there are delusions they are not expressed. The patient may remain quiet, but preoccupied, apprehensive, and fearful. Sometimes violence of conduct will first or principally attract attention; but if the case be one of delirium tremens fear will be mingled with violence, or will be the impelling motive. In some cases the tremor is comparatively slight, but some subsultus can usually be discovered. Constipation may or may not be present in a case. The stools are commonly dark.

Prognosis.—The prognosis is usually favorable in first attacks and uncomplicated cases. The mild cases usually end spontaneously in two or three days, the more severe in six or eight. But few uncomplicated cases end fatally except from repeated attacks. The temperature does not usually rise above 101° F. If it reaches 103° F., there is danger; and when, as is very rarely the case, it rises to 107° F., or 110° F., the case is desperate.

In typical cases of delirium tremens, if the illusions of the senses point to the skin and not to the deeper parts, the prognosis is favorable. A spontaneous cure is likely before long to take place.

If the patient alleges there is boring in the skull, or that some monster is in the interior parts of the body, there is more danger.

In cases where there is much gastric derangement and the symptoms are severe, if no other complications exist, the prognosis is still favorable. Other slight complications may protract a case, but still the prognosis may be favorable. When alcohol has not been taken for twenty-four hours, the cases with the conditions just stated will very probably recover spontaneously.

When severe complications occur there is danger. Gastritis is not unfrequent, and is sometimes serious. Chronic structural diseases of

the liver, the brain, the kidneys, the lungs, or the peritoneum, are likely to cause an attack of delirium tremens to be fatal. Acute pneumonia with this affection is peculiarly fatal. The pneumonia may be latent, and should be looked for by a careful physical examination. In all cases phlegmasia and surgical injuries are badly borne by hard drinkers, and when symptoms of delirium tremens occur during an inflammation from a severe injury, a fatal termination is to be feared. In essential fevers occurring in hard drinkers there is likely to be much delirium, but very rarely delirium tremens.

Death sometimes, however, occurs in simple cases of delirium tremens, and in the first attack. If the diagnosis as to a case being one of simple delirium tremens is not clear, if there be evidences of insanity presented by the symptoms, or suspected from heredity or constitutional tendency, the prognosis as to speedy recovery will be doubtful.

Diagnosis.—The diagnosis of delirium tremens is not difficult in typical cases. The observance of the phenomena as described, together with a knowledge of the habits of the patient, which can seldom be concealed, will distinguish it from other affections which it may resemble. “Tremulousness of the tongue and limbs, with apprehensive vigilance, if the patient be a drunkard, denotes an impending attack.”

If illusions of the senses and hallucinations of the mind follow, the attack is developing, and certainly so if fear is the predominant feeling. The physician must be on his guard in the case of secret drinkers. Caution in the expression of opinions, however correct they may be, is important, as they involve the standing and character of the patient. A wrong insinuation of the existence of this disease would be a most serious matter, as one who is reputed to have had delirium tremens will ever after be trusted by but few. It should be distinguished from inflammation of the brain or membranes, from the delirium of fevers and acute inflammations, from insanity, and, especially in reference to treatment, from delirium ebri-
osum.

If the mental state is not apprehensive—if it is gay or aggressive, malicious or furious, without fear or apprehension—if hallucinations from the first are joyous and not monstrous, the case is not simply delirium tremens, though the patient be a tippler. It is a case of insanity, caused it may be by alcohol, and the prognosis as to speedy recovery is doubtful. If there are clear indications of delirium tremens at first, with a change to an aggressive state afterward, or if the patient be sullen and maniacal, the prognosis as to speedy recovery is unfavorable. There is disease of the brain more chronic

than that of delirium tremens. Acute delirium excited by a more moderate quantity of alcohol in one very young will generally subside in a few days. Young patients drinking freely, eating nothing, and going without sleep for days, may have maniacal excitement, which will yield to food and abstinence from alcohol. This resembles delirium ebriosum, and usually soon terminates favorably from avoidance of the cause, but in older persons it is more grave than in the young.

If there are no terrors or tremors, but monstrous hallucinations which have occurred before drinking, though there be hard drinking afterward, the case is one of insanity. If after hard drinking there is melancholy, with delusions of hearing and sight, but without tremors, and if there are suspicions, jealousies, and sullenness, there is insanity, especially if there be sexual excesses.

A clear diagnosis, not only as to the nature of the disease but as to its severity, is of much importance in relation to treatment.

Treatment of Delirium Tremens.—Within the last thirty years the treatment of delirium tremens has undergone important changes. Formerly, when it was supposed the disease was due to the withdrawal of the accustomed “stimulant,” a resort to alcohol was thought essential. It had also been observed that sleep was followed by great improvement in all the symptoms, and it was advised that sleep at all hazards be enforced. The spontaneous occurrence of sleep is an evidence of the abatement of the disease, but the enforcement of the state is quite another thing; and since it has been generally known that the disease quite as often comes on in the midst of excess, and that when that is not the case the refraining is generally in consequence of the approach of the alarming symptoms, the alcoholic treatment has lost its former position.

The profession is indebted to Dr. Hall, of Boston, to Drs. Laycock and Gairdner, of Scotland, and to Drs. Wilks and Austin, of London, for pointing out the great danger of the excessive opium and alcoholic treatment, and proving by the results of experience that *expectancy* is greatly preferable to the free and indiscriminate use of opium and alcohol formerly practiced. In the Edinburgh Infirmary especially, under the administration of Dr. Laycock, the mortality was greatly reduced by discarding opium and alcohol entirely, and depending upon nourishment and proper care. This may have led to an extreme view of the danger of opium, and both it and alcohol moderately and discriminately used may be of service in managing some of these cases.

In the cases pointed out as having a favorable prognosis the withdrawal of the alcohol, the administration of easily digested and nu-

trititious food, keeping the patient as quiet as possible, and pursuing a strictly expectant course will be all that will be required.

In the severer cases, and with particular symptoms, other treatment may be useful. In undertaking a case, the natural history of the disease in that case must be judged of, and a definite prognosis made.

If it be thought that recovery will soon occur, much medication is at least unnecessary, and large doses of opium to enforce sleep will be likely to be injurious, and may be fatal. The same may be said, and with still greater force, of chloral hydrate. The administration of alcohol, which is the cause of the disease, will usually tend to favor its continuance. If opium or chloral is given in such quantities as may often be necessary to induce sleep, a fatal coma may result. This, however, does not prove but that under some circumstances certain doses will be useful.

In all cases the patient should be put to bed, his clothes taken away, and, as a rule, his family should be dismissed. Generally there should be a change of associations, and those he has been accustomed to govern will not be most successful in governing him. A firm and authoritative, but kind manner must be assumed by those who have immediate control of the patient. A bath (a proper sponging will do), should be administered, the room should be kept quiet, and, as a rule, mechanical treatment should be avoided. No straight-jacket or binding should be used, and if instruments of offense are removed from the room, the strength of one or two men will be sufficient to exercise all the restraint that the emergency will require. Generally the patient may be governed by a calm but decided manner.

Food should not only be offered, but the taking of it should be insisted upon. Farina and milk, crackers and milk, raw eggs beaten up, or eggs but slightly cooked; broths, concentrated preparations of beef, and solid food as may be borne should be given. All food should be warm when taken, and if rejected by the stomach it should be given by enema. If the patient be young and robust, and the attack be brought on by acute drinking, an eliminative may be administered first. A blue pill or a few grains of calomel, followed by a laxative dose of citrate of magnesia or other gentle cathartic, will often be of great use. In feeble cases the bowels may be moved by an enema and food given at once. If there be irritation of the stomach, ice or effervescing mixtures, and perhaps small doses of morphine will be required. It is the large and repeated doses which "enforce" sleep that are dangerous. If alcohol is still present in the stomach an emetic may possibly be useful, especially if at the same time the organ is oppressed with coarse or indigestible ingesta. The

patient should be carefully examined for complications. The action of the heart and of the pulse should be observed. The conditions of the brain, the lungs, the liver, the kidneys, and the bladder should be inquired into, and the treatment adapted to each condition. If the temperature is excessive, the cool bath, or sponging, or a pack should be resorted to.

The medicine safest, and at the same time most efficient, perhaps, in controlling excitement is the bromide of potassium or the bromide of sodium. These articles may be administered in decided doses, and may be repeated as may be borne or required. In failing heart's action digitalis has been strongly advised, and by some in enormous doses—as much as half an ounce, and even more, of the tincture. The propriety of such doses is exceedingly questionable. From half a drachm to a drachm of the tincture, and perhaps more, may be well borne, repeated with caution once in two, three, four, or more hours, but not very long continued in such doses, and it may sustain a heart that would otherwise fail.

In extreme depression, where the system is free from alcohol, and where food cannot be taken, alcohol in moderate quantities may be tried; but certainly not under other circumstances, and even then digitalis, moderate doses of opium, or Indian hemp, will often be better. Perhaps the best method of giving an opiate is in the form of morphine hypodermically; but the administration of *moderate* doses, watching carefully their effects, is essential. In some cases it will be advisable to give a more decided, but not an enormous dose at first, and smaller doses afterward, according to the effect. Opium has its uses in delirium tremens; it is only its excessive and reckless use that is to be condemned.

Absinthe and other articles have been advised, but have not received the sanction of long experience. Chloroform, as well as chloral hydrate, is of doubtful utility; and it is certain that, in not a few instances, death has occurred after free doses of the chloral. Dr. Laycock thought he often obtained effects from what he termed “mental hypnotics”—giving a drink of water and assuring the patient that it would induce sleep.

Inflammatory complications do not bear depletion well in delirium tremens, or in any form of chronic alcoholism. Quinine, and perhaps morphine, in anti-inflammatory doses, especially in pneumonia, are chiefly to be relied upon.

Tonics may be needed during convalescence from delirium tremens, and all means should be used to prevent a relapse into former habits of drink; but they will too often be proved to be without effect.

CHRONIC ALCOHOLISM.

By this is understood those less violent but more persistent effects of the long-continued use of alcohol which are much more common, and therefore more disastrous, than delirium tremens, delirium ebrius, and alcoholic eclampsia. Under this head are embraced both functional and organic changes.

Symptoms.—Among the first symptomatic phenomena will be observed a perversion of moral sentiment.

There will be a recklessness of the danger from drink, and a general recklessness of conduct—improvidence, sensuality, malfeasance in office, unfaithfulness to trusts, indifference to the feeling and claims of parents, wife, and children, and disregard of the advice of friends.

Disturbances of motor functions, unsteadiness of muscular action, tremors of the hands, or of the lower extremities, or of both; inquietude, restlessness in bed, want of refreshing sleep, depression of spirits, especially when the accustomed drink is withdrawn, are common. The irregular motions can be restrained at first by the will.

They are worse in the morning, especially when the sleep is broken, but are steadied by food and the usual dram. Buzzing in the ears, headache, clouds before the eyes, flashes of light (the last indicating more serious lesions), and hallucinations may follow. Uncertainty of purpose, mental inquietude, a feeling of dread, but without definiteness as to the object or a purpose to avoid the danger, are experienced. At length there is more marked impairment of coördination; a dread of falling and a sort of “day-mare” may occur. The flesh may be increased at this stage—a fatty accumulation taking place—especially in beer drunkards; and not unfrequently this is the case in whisky drunkards as well. In other cases there is emaciation. The countenance becomes flabby and expressionless, or rather it has the expression of alcoholism.

The vaso-motor nerves of the face are partially paralyzed, and the vessels are enlarged and congested, giving rise to the redness and the eruptions so often seen. The stomach is not unfrequently disturbed; there is morning vomiting or nausea; and a chronic gastritis, involving not only the mucous but the other tissues of the stomach, is sometimes developed. The bowels may or may not be similarly affected. The breath is foul, not so much in this more advanced stage from the vapor of the liquor, as from foul secretions and decomposing elements. A sort of swill-tub odor is observed.

Cirrhosis of the liver (the gin liver) sometimes occurs. Bright's disease of the kidney may be present (though this last is perhaps more frequently produced by other causes), chronic peritonitis, cerebral sclerosis or cerebral œdema, chronic interstitial pneumonia, fatty accumulations or degenerations, especially of the liver and heart, may occur, and a general degeneration and a lowering of vitality result. Profuse hemorrhage from the stomach sometimes occurs, and may be repeated. When these structural changes take place the end approaches. Some will endure the mere functional derangements for years. Others will have horrors, delirium tremens, and other severe symptoms sooner; but there is a lowering of tissue structure, a predisposition to particular diseases, a diminution in the power of resisting their causes and enduring their ravages, and the succumbing to these morbid influences is only a question of time and endurance. In some cases the end is preceded by sensory paralysis in the extremities, first in the upper and then in the lower, when severe organic diseases of the brain are apt to follow. Great tremulousness may precede the paralysis.

The amount of mental and moral impairment, in proportion to the physical, varies in different cases. Generally both are great. Feebleness of mind, cowardice, and untruthfulness are common characteristics in advanced cases. Some are suicidal or homicidal; others melancholy or demented; all are mentally and morally impaired.

Symptoms resembling locomotor ataxia sometimes occur, and a breaking down of nervous fibres in the corpora striata or optic thalami, or elsewhere, and the consequences—hemiplegia, general paralysis, apoplexy, convulsions, epilepsy, various derangements of the nervous centres, and a sad death follow; while painful memories are left as an evil legacy to friends.

Oinomania, *Methomania*, *Inebriety*, are forms of chronic alcoholism. By these terms is understood an insane desire for narcotics, and especially for alcohol, which is taken in great excess. This is a constitutional form of insanity consisting of a predisposition which is often hereditary, but which is brought into action and sometimes created by drinking habits. Symptoms of this state are often manifested early in life. It is paroxysmal, and the attacks are often accompanied with the excitement of other animal passions, and debauches with disgraceful actions of various kinds are indulged in. The patient is not sleepless and tremulous as in delirium tremens, but is furious and uncontrollable as to his indulgence in drink until the fit passes off. This may take place in a few days, or after a month or more; and the attacks are generally rhythmical. The intervening periods vary in length, in different cases, from a few weeks to many months. The recovery from each attack is accompanied with

mental depression, often with horrors, repentance, and resolves for reformation. But the symptoms recur, and generally with increasing frequency, and the cases are almost hopeless as to complete reformation. At least there is no security when the disease is once fully developed and liberty is enjoyed.

These patients are "reformed" many times by moral and social influences and in inebriate asylums, but rarely permanently. Prevention is the remedy for these cases. Cures seldom occur.

Diagnosis.—The distinguishing of alcoholism in its different forms is not usually difficult to those who are on the alert for the cause. The free indulgence in the poison, which can commonly be ascertained, will aid in this. The patient is apt, however, to deny the extent of his or her indulgence, and allowance for this must be made. Alcoholism may be mistaken for incipient general paralysis of the insane, for paralysis agitans, for locomotor ataxia, for sclerosis or softening of the brain and cord, for lead or mercurial poisoning, for various paralyses, for senile dementia, for epilepsy, and for hysteria or dyspepsia. The general paralysis of the insane is progressive; the phenomena of mental elevation, a belief in the possession of great riches or high position, will at length be manifest, and the other diseases named have already been described, so that a comparison here is not essential.

It should be borne in mind that various diseases may be modified and intensified by alcoholic indulgence, and it may be difficult to determine the part each plays in a given case.

Prognosis.—In chronic alcoholism the prognosis is favorable on the condition of removal of the cause, unless organic changes have taken place.

The great difficulty is in breaking up the vicious habit when once established. After material structural changes have occurred they are seldom repaired. The prognosis in simple delirium tremens, delirium ebriosum, and alcoholic eclampsia, has been stated to be favorable. But complications are apt to be present, and in repeated attacks, especially in old subjects, the danger is much greater.

In the first attacks of mania and melancholy the prognosis as to recovery is favorable, and there is little danger to life. If these attacks are repeated there is great danger that the disease will pass into confirmed insanity.

In oinomania, patients generally recover from the paroxysms, but recovery from the more permanent condition which induces their recurrence is always doubtful. Various complications, including insanity, are apt to supervene.

Pathology and Anatomical Changes in Chronic Alco-

holism.—In the poison of alcohol several effects may be recognized. It produces irritation of the stomach and bowels from its local action. It produces changes in the movements and vitality of the blood. As a consequence of these conditions, and by a more direct action, it impairs nutrition; and lastly, it has a special morbid action on the nerve-centres.

On the stomach it produces, especially when concentrated, irritation, congestion, changed secretion of the gastric glands, degeneration of the submucous tissue, destruction of the secreting structures, ulceration sometimes, and hypertrophy of the fibrous tissue. Absorbed, it has a special attraction for the nervous tissue, for the brain, and also, though to less extent, for the liver. It produces more or less paralysis of the vaso-motor nerves, it changes the relation of the blood and tissues, it diminishes oxidation, and causes congestion of the liver, the kidneys, the lungs, and the brain. It generally increases the sugar in the liver, and the water secreted in the kidneys. It increases the tendency to the production of abnormal fat in the tissues generally, and tends to produce fatty degeneration. Above all, it acts chemically upon the soft nervous tissue.

It causes, in its continued use, the proper nerve elements to waste, a serous fluid to be effused, and it induces in the nervous matter the production of granular fat, and causes development of the connective fibrous tissue. All parts of the body under its poisonous influence have a lower vitality.

Slow morbid changes occur in the lungs, the liver, the kidneys, the heart, the large vessels, and in every organ of the system. The cranial bones are often thickened, and become more dense. The nutrient nerves at length become paralyzed, producing results similar to what occurs in their division. From the nutritive changes in the kidneys and the lungs, there is diminished elimination of urea and other salts of the urine, and of carbonic acid from the blood. Whatever may be thought of the "moderate" use of alcohol (and no one has been able to define the limits of moderation), that these effects follow its immoderate use is not questioned.

Treatment.—In the early stages of alcoholism total abstinence from the poison, with a good nutritious diet, will usually be sufficient to restore the patient to health. When the stomach is much injured, care must be exercised in the selection of food. Milk and farinaceous substances, concentrated preparations of meat, scraped-beef balls, steak, roasts, etc., as may be borne, are required. Tonics will sometimes be useful, and digestion may be promoted by preparations of pepsin. The real stimulants and sustainers of the system are foods.

Under this management the symptoms, as a rule, will rapidly sub-

side, unless organic changes have occurred. Sometimes quinine in one or two grain doses, two or three times a day, will promote sleep and hasten recovery.

Temporarily, morphine may be useful. A tea-spoonful of sulph. ether at bedtime may promote sleep; but narcotics of every kind should soon be dispensed with.

Dr. Marcet advises oxide of zinc in doses of two grains after meals, gradually increased to eight or ten grains; but Dr. Anstie thinks quinine is better. For quieting irritation of the nervous system the bromides are in great favor, and, on the whole, are the safest and best agents in most cases that require soothing remedies.

Indian hemp, in one fourth to one half grain doses of a good extract, or from one tenth to one fourth of a grain of morphine given hypodermically, repeated once or twice a day for a time, may be useful. In more advanced stages, with greater failure of power—paralysis, mental impairment, etc.—codliver oil and hypophosphites, steadily administered—the oil especially for a long time—will be useful. Strychnia, when there is much tremor, in doses from $\frac{1}{4}$ to $\frac{1}{3}$ of a grain, but not in freer quantities, is indicated. Iron will sometimes be useful; and proper hygienic measures will always be essential, while special complications will require attention and appropriate remedies.

As in these cases the strength of will and power of self-control are often weakened even more than other faculties, restraint is essential to success, and too often all efforts at treatment come too late.

In view of the grave consequences of drunkenness and inebriety, prophylactic measures are of the utmost importance. To determine the best measures for this purpose the **Causes** of the evil must be considered. It is a simple truism to say that the cause of alcoholism is the use of alcohol, and the prophylactic remedy is its avoidance. There are various contributing causes inducing its deleterious use which are worthy of a brief consideration. Some of the causes are occasional and accidental, while others are more constant and deep-seated in the constitution—often hereditary.

The occasional causes which increase the temptation to drink are associations, the influence of example, opportunity, or uncomfortable surroundings, and morbid sensations, mental and physical, which are relieved by the narcotic action of alcohol. The morbid sensations, the depression from the secondary effects of this article, are often greatly relieved by a repetition of the dose; and repetitions establish a *habit*—a disposition to repeat the act—and in persons of certain constitutions an intense and uncontrollable desire for the article is induced.

The depression and uncomfortable sensations produced by the use

of other narcotics tend to produce indulgence in alcohol. In various nervous or painful diseases which alcohol will relieve, such as neuralgia, painful menstruation, the depression from lactation, the phenomena of hysteria, etc., treatment with alcohol will tend powerfully to induce a drinking habit. A more constant contributing cause is a congenital and generally inherited peculiarity of the nervous system, rendering a habit more easily contracted and more strong. Children of drinking parents, of the insane, of epileptics, and of those affected with neuralgia and other nervous diseases, are much more likely to be inebriates than others.

From a statistical report of two hundred and fifty-two cases of inebriety treated at the Inebriate's Home, Fort Hamilton, N. Y., from Nov. 1st, 1879, to Sept. 1st, 1880, made by Dr. S. D. Mason, physician to the institution, it appears that out of two hundred and fifty-two, one hundred had parents who were ascertained to be inebriates; in ninety-eight the father was intemperate, in four both the father and mother, and in two the mother alone, while in eighteen, other near relatives were drunkards. Fifteen had insanity in the family; and the number whose families had other nervous diseases is not given.

Dr. B. W. Richardson, of London, whose writings on various physiological and medical subjects are so well known, says: "Men and women who steadily indulge in the use of alcoholic drinks quickly and certainly attain one or the other stages of the alcoholic constitution. They may call themselves moderate drinkers, but as soon as ever they begin to feel that alcohol is a necessity, and that they cannot abandon it without a struggle, they are under its ban, and are to some extent physically impaired by it. Their blood-vessels are easily congested, their digestion is easily deranged, their spirits are quickly depressed, their muscular power is rapidly prostrated; and they grow, almost without exception, prematurely old, dying in the early years of the third term of life, that is to say, soon after sixty, from kidney disease, heart disease, lung disease, brain disease, or some other of the degenerations of the vital tissues which in healthier persons need not appear until the closing part of the fourth term, that is to say, until between eighty and ninety years, according to the present perfect fulfillment of human life." (Ministry of Health, pp. 346-7.) Any constitutional condition may be transmitted, and those who are called moderate drinkers may transmit by generation, as well as by example, a disposition to drinking habits in their children.

To show the relation of another narcotic to inebriation, it is stated in the report of Dr. Mason, before mentioned, that of the two hundred and eight males, two hundred and two used tobacco, and six did

not, and of the females, eleven used this article, and thirty-three did not.

Intemperance has often been attributed to a want of education, and this, and especially a wrong education, has an undoubted influence ; but of these two hundred and fifty-two inebriates, fifty-five, or nearly one fourth, are reported as having "received a liberal education, one in fourteen having had a collegiate course. Of the males, about one in eleven followed professions; a large proportion were skilled mechanics ; and of those engaged in business none were below medium in point of intelligence and capacity ; many exceeded this point." (Dr. Mason's Report.)

A desire for alcoholics, whatever the constitutional or hereditary predisposition, does not appear in those who have never used them ; but sometimes almost the first indulgence begets the desire. With others, only a protracted use will produce this desire ; and with others still, after considerable indulgence the desire is not great. While some readily contract a strong and uncontrollable habit, others keep control of themselves in regard to this indulgence, and may drink "moderately" for a long time without exceeding certain bounds. Most men in their earlier indulgence think themselves capable of this control, and indulge without apprehension of danger ; and when that danger is apparent to others it may not be to them, until the desire and the habit are too strong, the will too weak, or the indifference to consequences too great for any effectual efforts to change their course. The longer the indulgence the stronger the habit, the feebler the resistance, and the greater the indifference, until the victim is swallowed up in his self-invited destruction.

From this view of the facts, it becomes too obvious to need repeating that the remedy for drunkenness as a vice, and inebriety as a disease, is abstinence from alcoholic drinks. It would be an insult to the intelligence of the medical reader to say that the remedy for drunkenness is the use of wine and beer, of which alcohol is the essential ingredient, the same agent producing essentially the same effects as the alcohol in spirits diluted with water. That alcohol is not needed, and is, on the whole, the reverse of useful in health, however used, ought to be universally, as in this country it is generally, admitted. Its employment in medicine has already been sufficiently discussed in the preceding parts of this work.

The duty of the physician in relation to its use will be readily inferred from the positions taken, if they are regarded as having been sustained. That great caution should be exercised in prescribing it as a medicine, especially to be long continued, and still greater reserve in encouraging its use as an article of luxury, or for exciting more

agreeable sensations or emotions, when it is known to be fraught with such dangers, will be admitted by every well-regulated mind.

OPIUM EATING.—THE OPIUM HABIT.—OPIUM.

Acute Poisoning.—The immediate effects of a medicinal or a poisonous dose of opium or its derivative, morphine, need not here be described. Its therapeutical effects have been frequently mentioned in connection with the various diseases for which it has been advised. Its immediate poisonous effects are to be combated, first by removing it from the stomach, from the intestines—if supposed to be there—and from the bladder after its absorption into the blood and secretion from the kidneys. The evacuation of the bladder, in the latter stages of the poisoning, is a matter of importance to prevent reabsorption.

Next in efficacy to the evacuation of the poison is the administration of atropine. This exerts an antagonizing effect, and is most prompt in its action when given hypodermically.

Coffee in free doses, often repeated, tends to counteract the opium, and the electric or galvanic current may be used for keeping up the respiration until the poison is eliminated. Artificial respiration should not be neglected where the breathing threatens to cease. Causing the patient to walk when it is possible is proper, and flagellation is sometimes resorted to.

Chronic Poisoning.—The protracted use of opium, with the enormous increase of the dose which is usual, induces a very serious morbid condition. The effects upon the different functions of the body and the mind vary in different cases; but in all a depraved condition is induced, physical and mental, and in very few is a cure effected after the habit is thoroughly established. The suffering is so great from uneasiness, irritation, and pain, when the opium is withdrawn, or even when the quantity is not progressively increased, that few will resist the temptation to resort to it for the temporary ease and delight which it affords. A time at length comes when it will cease to give the relief which for a long time will be experienced by its use, and the patient is reduced to a most wretched condition of physical and moral degradation.

In China it has become a national vice and calamity, and is seen on a large scale. The victims, pale or parchment colored, haggard and emaciated, are scarcely able to drag themselves about, and can only manifest a little energy when a new dose excites them.

Many individuals in Europe and our own country fall into the

practice, sometimes by the neglect of the physician to keep the administration of the drug in his own hands when prescribed for a length of time, the patient continuing its use until a habit is formed.

Although a great deal of functional derangement occurs from the habit, and anæmia and general emaciation often take place from the impression made upon the nervous system, inducing not unfrequently insanity and leading to other sad results, yet no definite structural changes of the nerve-centres have been discovered, and the disease it induces is regarded as functional, recognizable only by the symptoms produced.

Treatment.—The remedy is the abandonment of the practice and the breaking up of the habit. Two methods have been advised—one consisting in the gradual decrease of the amount consumed; and the other in leaving off the drug abruptly and entirely. The latter method is perfectly safe, is more efficient and, of course, more speedy, and, on the whole, is accompanied with less suffering. As a rule, however, whichever method be adopted, the patient, unless under restraint, returns to the indulgence, and the treatment fails.

Various articles have been used as substitutes for the opium, especially when the gradual plan is adopted. Quinine, strychnine, and cannabis Indica are among the articles that are advised, and also other nervoties, such as camphor, valerian, chloral hydrate, the bromides, etc.

The substitution of chloral hydrate is scarcely an improvement—indeed may be worse than the opiate—and the other articles are unsatisfying. Recently coco leaves have been recommended as an agent capable of allaying the suffering of persons discontinuing the habitual use of opium and enabling them to break up the injurious practice; but this article has not been sufficiently tested to establish its value. The favorable reports that have been made render it worthy of a further trial.

My own success with opium eaters has been for the most part very unsatisfactory, and this is the case with most who have had experience in such cases.

The great remedy is prophylaxis—avoiding the establishment of the habit with patients—and in this I have more reason for self-congratulation.

The physician should keep the administration of this important remedy under his own control, should stop its use in due time, and be faithful in warning the patient of the dangers of the habit when he fears its formation, before it becomes established.

Habits in the use of chloral hydrate are sometimes formed which

are quite as dangerous, if not as tenacious, as those of opium eating. These require similar management.

The same substantially may be said of hasheesh eating.

“ETHER DRINKING,” to the production of intoxication, has become a prevailing practice in some communities, particularly in Draperstown, in the north of Ireland. The practice is thought by those who have investigated the subject to be less injurious than alcoholic intoxication, as the effects are far more transient. Sudden death, however, occasionally arises from it, and its long continuance must produce injurious effects.

TOBACCO POISONING.

Tobacco is well known to be a powerful poison, capable in proper quantities of producing speedy death. It causes, in small quantities, to those unaccustomed to its use, nausea and often vomiting, accompanied with great weakness and faintness. It confuses the ideas, dims the sight, enfeebles the action of the heart, and produces paleness, coldness, and clamminess of the skin. Nicotine, its most active principle, according to Velpeau, Rosenthal, and others, produces paralysis of the spinal cord and motor nerves, the peripheral nerve endings being first affected, and also paralysis of the muscles. It not unfrequently tetanizes the heart of animals upon whom experiments are made, resulting in the speedy interruption of its pulsations. That it especially acts upon the human heart, those who have had observation of its effects, and who have recognized what has been called the “tobacco heart,” can testify. That, like other narcotics, it often soothes the uncomfortable sensations, relieves the irritable and uneasy feelings, and quiets the restlessness produced by its habitual use, there can be no doubt; and this enables some to speak with a degree of sincerity of its beneficial effects. Most persons, however, who use it admit they would be better without it; and there can be no doubt that it lowers the general tone of the nervous and nutritive systems, destroying the natural balance of the functions, and when freely used (and the tendency is to a progressive increase in the quantity taken) does unequivocal and often very great mischief.

It is particularly injurious to the young and adolescent, and although different persons differ greatly in their power of endurance of this as of other poisons, there can be no doubt (at least there is not a shadow of doubt in my own mind) that its use is an evil of very great proportions, with scarcely a mitigating circumstance in its favor.

That it tends to cause intemperance in the use of alcohol, both

statistics and common observations seem to show. In the vacillating condition of nervous sensibility which any unnatural neurotic agent so certainly induces, feelings of depression at times occur for which relief is sought by the use of the same or various other narcotics or so-called "stimulating" articles. At the very best an artificial life is produced which is the reverse of an improvement upon the natural.

All agree that the *excessive* use of tobacco is particularly injurious, but, as with alcohol, the line between moderation and excess has not been drawn. True *temperance* consists in the moderate and proper use of all necessary and useful things, and in the avoidance of all that are injurious. We would not speak of the temperate habitual use of opium, chloral hydrate, or hasheesh, and to my mind there is an equal impropriety in speaking of the "temperate use of tobacco."

Several of the special morbid conditions which its free use induces have already been referred to. The foul breath, the foul tongue, the nervous irritability, the neurasthenic heart, the cachectic pallor, the weak and unsteady muscles, and the indifference to the sensibilities of those who abhor the fumes and the sight of tobacco, are familiar to all who observe.

As no defined structural changes in the nerve-centres are known to be produced by tobacco, most of its evil effects soon subside when its use is abandoned. Not all, however. The craving for the narcotic, though commonly subsiding in a few weeks, is sometimes more persistent; and the habit of its use, when fully formed, is not often broken up. When it is so, in too many cases some other narcotic, with effects still more disastrous, takes its place.

The remedy for all its evils is the complete abandonment of its use; and this is only to be effected by a strong and determined purpose on the part of the patient. Attempts at moderation very generally result in the resumption of the excesses; and when injury has been done by excess, even moderate and unsatisfying quantities will protract the injury.

Prophylactic treatment—preventing as far as possible the formation of the unwise habit of smoking, chewing, or snuffing—seems the duty of those who have responsibilities respecting the health of others.

The use of *tea* and *coffee* is so general, and the injurious effects of a moderate indulgence in them are in a majority of cases so slight, that to speak of them in their ordinary use as *poisons* would be employing too strong language. They are capable, however, of producing injurious effects, and they are by no means necessary to human health or enjoyment. They are unnatural excitants to the nervous system, and the excitement and wakefulness they induce are followed, as a rule, by a corresponding depression. Their food properties are in-

significant, and if they interfere, as they sometimes seem to do, with the retrograde metamorphosis of tissues, this, instead of being an argument in favor of their use in the physiological condition, is rather one against it, as normal metamorphosis should not be interfered with. The molecules, when their life is normally exhausted, should be replaced and the tissues renewed.

The diseases produced by these articles are chiefly neuropathic—neuralgia, cephalalgia, a want of balance of nervous excitability, and dyspeptic conditions. Wakefulness, tremors, palpitations, and a variety of “nervous” symptoms are often produced by their free use, and are remedied by their abandonment. Coffee not unfrequently causes irritation of the bladder, which only requires discontinuance of the beverage for its relief.

Children particularly should avoid these articles; and the nearer all persons keep to simple water as an ordinary beverage, the better for their permanent well-being. Long-continued observations and experience have impressed me with the truth of this statement. When milk is freely used it answers both as food and drink; and while it is especially adapted to the wants of children, it serves an excellent purpose in the dietary of most persons at all ages.

NEURALGIA.—PERIPHERAL HYPERÆSTHESIA.—SENSITIVE NEUROSIS OF PERIPHERAL NERVES.

Definition and Pathological Phenomena.—The term neuralgia has been very loosely used. It literally means pain of nerves; but all pain, certainly all outside of the brain and cord, is felt in nerves and by nerves.

Exaltation of sensation—pain—as we have seen, is a frequent condition. It is present to a greater or less extent in most diseases and injuries.

In diseases of the brain and spinal cord—organic and functional—pain is a frequent symptom, and is found in these cases in different parts of the body. Pains that are situated in the periphery, but without evidence of other disease in the part where they are felt, are often called neuralgie, even when organic disease exists at a distance in the nerve-centres or in the course of the nerves themselves.

The use of the term in this article, unless otherwise designated, will be confined to those cases where the pain is functional—that is, where no organic disease is discoverable, where the pain is the chief or only apparent morbid condition, and where it is situated in the course or at the extremity of the nerves concerned.

Dr. Flint says: "The term neuralgia is used to distinguish functional affections of which the chief characteristic is pain." It may be further defined as pain following the course of particular nerves, of a darting, stabbing, twinging, or burning character, not necessarily accompanied by fever or local visible changes. The quantity of blood in the part where the pain is felt may, however, vary from the normal by involvement of the vaso-motor nerves, causing spasm or relaxation of the vessels. The pain is usually intermitting in character, though in rare cases it is dull and steady.

These intermissions or remissions vary in duration from a few seconds to much longer periods. Usually pressure can be borne at the seat of the pain, especially if a large surface be pressed upon, but in some cases, especially where the disease is of long standing; great tenderness is felt, so that the slightest touch, a breath of air, or a sudden change of temperature of the part will produce spasms of intense pain.

The involvement of vaso-motor and trophic nerves may produce changes not only in circulation but in nutrition in the region of the pain, and inflammation and ulceration may follow; but in neuralgia the pain precedes these changes, and when they occur the disease takes other names than neuralgia.

The irritation which causes neuralgic pain may be in the brain, the spinal cord, or in the course of the nerve; but the pain is most felt, commonly, at the extremity of the nerve where its branches unite with the other tissues. Sometimes the source of irritation is in other nerves, or parts at a distance from the seat of the pain. These are called reflex pains, and with some impressible persons they are frequent and severe.

Neuralgic pains may occur in any part of the body. Those that occur in internal organs—in the digestive, respiratory, circulatory, and urinary systems—have been spoken of in connection with other diseases of those viscera.

There are certain characteristics of neuralgia which are the same wherever the pain is located. These will first be considered, and mention will afterward be made of those belonging to particular parts. Increased sensibility or pain of nerves presents two forms. In the first, functional activity is brought into play by impressions acting upon the nerves; but from their intensity, or from increased susceptibility of the nerves themselves, instead of the ordinary sensations, pain is produced. In the second form the pain is spontaneous, and lasts till the excitability is exhausted. In the first case there is exaggeration of excited sensation amounting to pain; in the second, the existence of the sensation is entirely abnormal. The first is symp-

tomatic of other diseases or morbid states, and there is an increase of functional activity from the strength of a morbid impression.

The second, or that arising in the nerve spontaneously, is *neuralgia* proper. This spontaneity does not imply the absence of a cause capable of producing the effect; but the cause is not associated with the exercise of the function of sensibility—is not of a character which ordinarily makes a sensory impression.

Etiology and Symptomatology.—Neuralgia, as thus defined, has several general causes. It may arise from an intrinsic and primitive modification of the excitability of the nerve itself in its continuance, or in some part of its course. It may be from some extrinsic lesion in a distant part operating by reflex action; or it may arise from some constitutional states which modify nervous excitability, as from changes in the blood or in other general conditions of the system. Neuralgia arising from the first of these causes is essential or primary. That arising from the other two is secondary or symptomatic. This distinction between primary and secondary, or symptomatic neuralgia, is important, especially in reference to treatment.

Essential or primary neuralgia depends upon a primitive alteration in the excitability of the nerves. This may be hereditary or the result of causes—physical, mental, or moral—operating for a long time upon the organism. The modification is a constant one—the increased excitability is present for long periods, in many cases at least, though not at all times appreciable or manifested in symptoms. The tissue of the nerve is not known to be materially changed, but its function is morbidly modified. There is thus a neuralgic temperament ready to show itself spontaneously, or to be brought into morbid activity from slight causes. Microscopical structural changes have been found in nerves that have been dissected out for long-continued and severe neuralgia; but whether the changes in these cases are the cause or the result of the pain has not been determined. Neuralgia of the different kinds occurs most in those who are called nervous persons—those whose nervous system is not strong or well balanced.

There is, in most cases at least, weakness, general or local, and often anæmia. Anæsthesia of the part may precede the pain; depressing influences, fatigue, and exhaustion increase it, and it is usually relieved by rest and suspended by sleep. Its intermitting or remitting character is usually well marked, and in a majority of cases the pain is superficial. In most instances it is unilateral, or if it affects both sides of the body it is not apt to be in corresponding points.

There is often tenderness, limited to certain points in the course of the nerves affected. As pointed out by Valliex, these tender points

are most likely to be felt where the nerve trunks or branches emerge from the skull or spinal cord; over branches which penetrate or emerge from muscles on their way to the integument; at the termination of the branches, and in places over trunks that are near the surface. Pressure upon these points with the ends of the fingers, or percussion upon them, and not slow pressure upon a large surface, reveals the tenderness. Pain is generally increased by sudden or violent movements, though mental impressions, arresting the attention, may diminish or arrest the pain.

Injury of nerves—violence, shock, partial divisions, bruises, and the presence of foreign bodies within or pressing upon the nerves—tumors, neuritis, contraction of cicatrices involving nerves, etc., will produce pain, and it is more severe in those of a neuralgic temperament. In such cases the pains are both organic and functional. Nerve pains of all kinds are apt to be aggravated by weakness.

When pain exists we should search for a cause. We should first examine the part; then the course of the nerve supplying it; then other branches of nerves; then the brain and cord, or any part that may produce reflex pain; and if no such cause is found, we may pronounce it, tentatively at least, *primary* neuralgia. We call it neuralgia when no discoverable disease is in the part except pain, or where the pain is the primary condition. The search for a cause, if unsuccessful, has been useful, as giving a better understanding of the case, and leading away from wrong, if not to correct, remedial measures.

There are various general conditions that act as causes in the production of neuralgia. The female sex, or the influences to which women are subjected in our civilization, the period of development or adolescence, middle life, and the time of bodily decay, especially when combined with anæmia and any form of malnutrition, predispose to neuralgia. The use of narcotics and various neurotic agents—alcohol, opium, tobacco, tea, and coffee—and the condition of oxaluria or oxalæmia, and the poison of malaria excite it. Exposure to cold is also an exciting cause. From much observation I am convinced that tea and coffee frequently produce neuralgia, especially in women who take but little out-of-door exercise, and in working-women who allow these articles to supply the place of more substantial food. Severe sufferers have often been wonderfully relieved or completely cured by abandoning the use of these articles, when no other changes would account for the result.

Romberg, in speaking of the causative action of anæmia, says, "it seems as if pain were the prayer of the nerve for healthy blood," and it seems to me to be very often the protest of the system against unnatural nervous excitants and artificial modes of living. •

Oxaluria, or rather oxalæmia, is a more frequent cause of neuralgia within my observation in the North-west than the accounts in most of the works on neuralgia would lead us to suppose. From my observations in New England, and near the seaboard, I am convinced that it is less frequently a cause there than in the West. In Southern Michigan, Northern Indiana, Illinois, and Ohio, from which regions I have seen many neuralgic patients, oxaluria is very generally present, and improvement of the neuralgia generally follows the removal of that condition. Great attention should be paid to this state of the secretions and the blood in various diseases of the nervous system, and in none more than in neuralgia. An examination of the urine for oxalates and other conditions is usually required in all forms of nervous as of so many other affections.

Various complications of neuralgia occur, and some of these are the results of the neuralgia.

There may be spasms and other motor disturbances, and perversions of the special senses, especially of vision and hearing. These may be more or less obscured, and sometimes lost. There may be various modifications of nutrition, as congestions, inflammations, eruptions, hypertrophy, or atrophy. There are often disturbances of secretion, lachrymation, salivation, and mucous fluxes. The functions of the stomach, the bowels, the kidneys, and the liver may be affected. The hair may be changed in color, or become coarse, or it may fall out. Local paralysis may take place. The eyes may become injected, the cornea clouded, the pupils dilated, or iritis induced. Herpes, especially in intercostal neuralgia, prurigo, and even periostitis in rare cases are complications. A severe and obstinate form of neuralgia is sometimes met with about the anus, with fissure and abrasion of the parts, and with extreme hyperæsthesia, where, after the rupture of the sphincter and the healing of the fissure, the neuralgia still persists.

To sum up the pathology and etiology of neuralgia, it may be stated that there are no fixed anatomical facts upon which reliance can be placed—no positive information as to the exact changes which take place or their precise seat. Pressure upon nerves at their origin or in their course, injuries of the nerves of various kinds, inflammation or sclerosis, etc., will often produce pain of this neuralgic type; but these are not cases of pure neuralgia.

In protracted cases of pure neuralgia of a severe character—those coming on without previous injury or perceptible changes in the nerves—certain structural changes in them follow; and it is thought that in some instances a tendency to atrophy of the posterior roots of the spinal nerves affected has been detected. Neuralgic pains may be produced by injury, pressure, and organic disease of the nerve-centres,

and especially the nerve trunks, at a distance from the seat of the pain. They may be produced by injury or disease of other branches of the same nerve, or of other nerves, the effect being produced by reflex or irradiated action.

They may be produced by injuries or disease of various tissues in distant parts, communicated by the same reflex or sympathetic process, or by various other morbid states, constituting complications. More purely neuralgic suffering may be produced by various poisons and injurious substances taken into the system. Lead, arsenic, alcohol, opium, tobacco, tea and coffee, and the malarial poison are the most common of these. It may be produced by injurious materials developed within the system, or retained from deficient elimination—such as oxalate of lime, urea, uric acid, carbonic acid, fæcal exuvia, etc.

The neuralgic constitution, with the development of frequent pains, may be produced by hereditary influences. It may be derived from parents suffering not only from neuralgia, but from various other nervous diseases, such as hysteria, insanity, epilepsy, alcoholism, the opium and tobacco diseases, hypochondriasis, etc.* Neuralgia may arise from imperfect development of the central nervous system; from anæmia, fatigue, and other depressing influences; and from increased nervous susceptibility, the result of education and habits, and of the peculiar, scarcely definable influences of our civilization. This and other nervous diseases appear to be on the increase in this country, and this is due to the combined effects of our climate and modes of life. There are but few women, especially in city society, who do not suffer more or less from pains which must be regarded as neuralgic or allied to neuralgia; and many men of the professional, mercantile, and even laboring and agricultural classes suffer, and sometimes extremely, from this disease.

Diagnosis.—The diagnosis of neuralgia is to be made by excluding other morbid states, and by a careful observation of the phenomena which have been described. The character, situation, and direction of the pain, the fact that it follows the course of the nerves, that it is unilateral, that it comes on suddenly, though often with premonitions, and that its character is intermitting or markedly remitting, point to its nature. A full history of the case will often be important in determining the characters of the affection. It will be important to inquire whether neuralgic attacks have occurred before, whether the pain was preceded by general depression, by numbness and tingling, whether it was excited by cold or dampness or shock, whether the tender points of Valliex are distinguishable;

* The children of all such parents are apt to be neuralgic.

whether secondary affections of the glands, hair, skin, etc., with pain preceding, are present; in short, whether the phenomena correspond with the description given. It should be distinguished from myalgic, rheumatic, and gouty pains, and from the phenomena of hysteria, though it may be mingled with all these conditions, and particularly with the latter. In dealing with neuralgia it is of great importance to determine whether it is primary or secondary, and whether it is the expression of a local irritation, or the peripheral indication of a central morbid process. It is sometimes not only necessary to obtain an accurate history of the past, but to observe for some time the development and progress of the disease. When it is of cerebral origin it is accompanied by headache, especially of the forehead and temples, and it is unilateral; there are often contractions of the face; there is likely to be general hyperæsthesia or morbid sensitiveness, with more or less psychical symptoms. A peculiar form of mental derangement, accompanying and dependent upon neuralgia, has been recognized by Griesinger and others, which has received the name of *dysthiagmia*. This state has not been very clearly defined, but it is attended by feelings of discomfort in the forehead or epigastrium, depriving the patient of the ability to follow any pursuit. This discomfort is increased at times to so intolerable a degree as to induce suicidal or frenzied homicidal acts. These symptoms increase or diminish with the increase and diminution of the neuralgic pains, showing their connection with neuralgia.

Spinal neuralgias are generally preceded or accompanied by other morbid sensations than the simple pain, such as sensations of cold, of formications, of fatigue, of genital irritations, abnormal susceptibility to galvanic currents in certain spots, and extreme sensibility to winds and moisture.

In hysterical neuralgia there will be the ordinary symptoms of hysteria, such as occur without the pains, and generally with the disposition to magnify the suffering.

In anæmic neuralgia, that accompanying condition is readily distinguished by the pallor and debility; and the pains dependent upon lead, mercury, the narcotics, etc., are distinguished by the other evidences of the action of these poisons and the history of the case. Neuralgia from oxaluria is to be distinguished by finding crystals of oxalate of lime in the urine, by irritation often of the urinary passages, by irritability of the general system, by giddiness sometimes, and by other evidences of that perversion of the digestive and nutritive processes which usually accompanies this state.

Prognosis.—The prognosis in neuralgia will depend much upon the cause which produces it, and upon other associated conditions.

Neuralgia is not immediately dangerous to life. The prognosis with reference to the continuance of the disease in most cases is uncertain. The affection has no fixed duration. An attack may end, under treatment or spontaneously, in a few hours or days; or it may continue, usually with abatements, for years or during a lifetime. Some local forms are particularly obstinate, and the general neuralgic tendency is often, with great difficulty and sometimes is never, overcome, whatever course of treatment may be pursued.

Treatment.—The treatment of neuralgia may be divided into rational and empirical, into constitutional and local, and into curative and palliative.

Rational treatment is based upon a knowledge of the causes, and consists in endeavors to remove them by the use of remedies which operate in a manner that is understood. Empirical treatment consists in the use of remedies which have been found to do good in similar cases, the mode of the curative effect not being understood. The constitutional treatment, as distinguished from local (the latter being mostly palliative), consists in the administration of medicines which operate upon the system at large; and these remedies are of two classes; the first are those intended to improve the general condition, and particularly the state of the blood, and are curative in their tendency; and the second are narcotics and stimulants, which are for the most part palliative.

In most cases improvement of the general condition is alone radical; although the neuralgic pains depending upon local causes are radically treated by removing such causes. As the disease depends upon a variety of causes, in attempting their removal a variety of remedies will be required. The indications presented by the various conditions must be followed. When there are impurities of the system, as from obstructed secretions, eliminatives are demanded. The digestive process, so often impaired, must be improved. If there be constipation, it must be removed; if oxaluria, that condition must be corrected. All wrong habits must be broken up, and all excesses prevented. Tobacco should be prohibited, and also tea and coffee, especially if taken freely. There is often a deficiency of fat in the food. This should be supplied. Codliver oil, pancreatic emulsion, cream, etc., should be given. If there be anæmia (which is so frequent) iron, quinine, and strychnia and other tonics will be indicated. Various means may be required for the improvement of the digestion, for the details of which the reader is referred to the article on Indigestion or Dyspepsia.

Hydrotherapeutic treatment, by diminishing the excess of local or general sensibility, and soothing the excitement of the nerves or their

centres by acting on the nerves of the skin, may be of essential service. Whenever it has the effect to improve the general condition of the system it becomes an important remedy. With a view to the general systemic improvement, and to sustaining the nutritive functions, and supplying materials for the repair of the waste of the nerves and brain, phosphorus, the hypophosphites, and other compounds of this agent are often important. They may require to be continued for long periods. If malaria be suspected as the cause, whether there be distinct periodicity or not, the antimalarial remedies—similar to the treatment described for ague—must be used. The same elimination and the same full doses of antimalarial remedies must be prescribed. The same rules as to the promptness of the treatment, and the avoidance of its unnecessary protraction, are to be followed. A periodic neuralgia in the ophthalmic branch of one of the fifth nerves, described as “brow-ague,” is often not only severe but obstinate, and may require quinine in large doses. Arsenic, in repeated attacks or in obstinate cases, may be indicated. A combination of quinine and iodine, or arsenic and iodine with proper eliminatives, will in these cases be often useful.

The urine should be examined, and if found to contain oxalate of lime or much free uric acid, the nitro-hydrochloric acid will be particularly useful if continued a sufficient length of time. If the patient is syphilitic, iodide of potassium or mercury will be essential. If there be gout, colchicum, eliminatives, and other appropriate remedies should be used. In “rheumatic neuralgia,” where there is inflammation in the fibrous structure about the nerves, iodide of potassium in from five to ten grain doses, combined or alternated with alkalies, will often be found particularly efficacious. Hydrochlorate of ammonia will often be found a useful eliminative, tending to remove exudations when they are present. Arsenic, by its catalytic effect, often improves the blood and the general condition, and has quite a wide application in neuralgia, in other than malarial cases. It is thought to be particularly useful in cardiac neuralgia, especially when administered hypodermically in doses of from four to six drops of Fowler’s solution in as much water.

In short, the general condition is to be improved by all rational means, and any local disease that may be supposed to have an effect in producing the pain by reflex action must receive attention.

As palliatives various neurotic agents are useful. There is a temptation, from the severity of the pain and the complaints of the patient, to resort to narcotics as the chief remedies, to the neglect of the more curative and rational measures. For the immediate relief of the pain morphine is the most efficient agent, especially when used hypo-

dermically; it almost always produces relief, and sometimes it effects cures. It produces its effect by entering the circulation, and may be introduced at any convenient point; but injected at the immediate seat of the pain, or in the course of the nerve affected, its action in procuring relief is sometimes speedy and complete. If the part is very tender, the ether spray may be used before the syringe. The dose should not be large at first. From the tenth to the sixth of a grain may be tried once or twice a day, the quantity to be increased if found necessary. Next to morphine in value, as a palliative, is atropia. It is often effectual in ovarian neuralgia and in dysmenorrhœa. A good extract of belladonna may be used in doses of from one sixth to one half a grain; or the atropia may be used hypodermically in from the one hundred and twentieth to one thirtieth of a grain. A combination of morphine and atropia will sometimes have a better effect than either alone.

Dr. Brown-Séquard at first gave one half grain of morphine with one sixtieth of a grain of sulphate of atropia hypodermically. He now uses and thinks it safe to advise the following: \mathcal{R} Morphiæ Sulph., gr. $\frac{1}{2}$ to $\frac{2}{3}$; Atropiæ Sulph., gr. $\frac{1}{15}$; Distilled Water, gtts. xx—for a hypodermic injection. These agents, by their acknowledged antagonism, prevent each other from producing poisonous effects upon the brain, while their good effects in relation to the pain are not prevented.

These doses are larger than are commonly advised, and I should feel much hesitation in giving such large doses to persons unaccustomed to narcotics, especially to those who are young and delicate. By commencing with smaller doses, and gradually increasing them, noticing the effect, the danger would be avoided while the object would be accomplished, though perhaps not as promptly as by the more heroic doses at first. After experience in each individual case, the larger doses, if found safe, might be used.

The chloral hydrate, in appropriate doses administered with care, will often relieve the pain; and croton chloral in doses of one or two grains, repeated once in one, two, or three hours, has a reputation with some, especially in neuralgia of the head and face. Indian hemp in doses of from one fourth to one half a grain, or a proportionate dose of the fluid extract, is especially useful in some forms of neuralgic headache. It may be given every night for a time, whether there is pain or not, and sometimes with the effect of preventing a recurrence.

Sulphuric ether in doses of a tea-spoonful or more, in gastralgia or in ovarian or uterine neuralgia, is often useful.

In angina pectoris the inhalation of nitrite of amyl is most speedy and efficient, but sulphuric ether will also be applicable. Aconite has been advised as a narcotic, but it is uncertain in its effect, it often

irritates the stomach, and produces too much depression. Alcohol in free doses will sometimes produce an anodyne effect, but it is less useful and more dangerous in its ultimate effects than most other narcotics, and should seldom be prescribed.

The bromides are often useful in diminishing neuralgic suffering, but they have less effect upon the pain than upon some of the accompanying conditions. They often diminish the general irritability of the system, and in some forms of neuralgic headache the bromide of potassium in free doses is very efficient.

There are various empirical remedies that have obtained reputation in neuralgia, having some supposed antagonizing effect upon the disease. Some of the remedies that have been mentioned as operating on what are called "rational principles" may antagonize not only the pain for the time being, but more permanently the disease. The croton chloral, the muriate of ammonia, and the bromides may operate in that way.

Arsenic and quinine are thought to antagonize neuralgia. It is certain that quinine in full doses of from fifteen to thirty grains a day, continued for some days, will often be very efficient in arresting neuralgic pains, and the effect is sometimes permanent. Arsenic also is found efficient in some cases, independent of its antimalarial influence.

Gelsemium has obtained a reputation as a cure for neuralgia. It certainly often relieves the pain, especially of the dental and other facial nerves; but in doses sufficient for that purpose it produces giddiness, haziness, and sleepiness, and in overdoses its toxic effects are dangerous. Ten minims of the tincture, three times a day, is as much as can safely be given at first; but the dose may be varied according to its effect.

Ergot has been recommended. The oil of turpentine in drachm doses internally has its advocates. The valerianate of zinc, the iodide of potassium in free doses, the bromide of potassium—especially when the symptoms are connected with sexual excitement—given in free doses of from one to two drachms a day, may antagonize neuralgia, and at any rate such treatment is often very useful.

Phosphorus is strongly recommended by some as an antagonizing article, and in cases of nervous exhaustion from excessive mental application it may be of much service, acting on rational principles. Monobromated camphor, bromhydrate of quinine, salicylic acid, nitrate of silver, chlorate of potassium, and still other articles have been recommended; and in obstinate cases when the means for fulfilling what are regarded as rational indications have failed, these various remedies may be tried. It is found that without a

rational explanation the remedy that fails in one patient and with the same one at one time, will succeed in another patient or in the same one at another time. Different compound prescriptions have obtained a reputation in neuralgia. An exceedingly complex formula of Dr. Brown-Séquard, which would be regarded as of questionable propriety did it not come from so high a source, and had it not been found useful in so many cases, is as follows :

R	Ext. Belladonnæ.....	gr. $\frac{1}{6}$
	Ext. Stramonii.....	gr. $\frac{1}{5}$
	Ext. Cannabis Indiæ.....	gr. $\frac{1}{4}$
	Ext. Aconiti.....	gr. $\frac{1}{3}$
	Ext. Opii.....	gr. $\frac{1}{2}$
	Ext. Hyosciami.....	gr. $\frac{2}{3}$
	Ext. Conii.....	gr. j
	Pulv. Glycyrrhiza.....	q. s. (1)

For one pill.

M.

He advises three, four, and even five pills in a day, in severe cases.

An antagonizing action of these articles one upon another must be produced, or such an accumulation of narcotics, each in the ordinary dose, would be overpowering to the nervous system as well as to the disease. Experience has proved that such doses may be given without great constitutional disturbance.

Various local remedies are used, mostly palliative, but some are curative. Counter-irritation is often efficient in relieving the pain. Liniments of ammonia and camphor, applications containing the tincture of aconite, the oil of peppermint or oil of turpentine, chloroform liniments, mustard plasters, etc., are used. As counter-irritants, small flying blisters of cantharides have most reputation. They may be repeated for a considerable length of time, and after each application a rapid healing of the blister should be encouraged. Permanent relief by this method is not unfrequently procured. Thermal treatment is also sometimes useful. For ordinary purposes heat is best applied by means of a hammer placed in boiling water until it becomes of its temperature, and touched to different parts near the seat of the pain, or in the course of the affected nerve. The hammer should be held in contact with the part a sufficient length of time, in ordinary cases, to produce redness only and smarting, but sometimes a limited superficial blister may be produced. An iron heated to redness or whiteness, and only instantly or superficially touched to the skin, is advised by some,

and relief by these means is sometimes speedy and occasionally permanent.

On the other hand, the application of ice to the spine by means of the spinal bag is recommended by Dr. Chapman. The efficacy of this method I have not sufficiently tested to justify the expression of an opinion.

Dr. Bartholow speaks very highly of deep injections of chloroform. He advises that from five to fifteen minims of chloroform be slowly thrown into the painful part, so as to reach the neighborhood of the affected nerve and be diffused into the tissues surrounding it. He deems it important that it should not be injected superficially into the subcutaneous tissue, as then the pain is great and there is danger of producing abscess and sloughing. He regards the effect of the chloroform as local upon the painful nerve, and not general upon the system, and therefore insists upon its being injected into the immediate region of the affected nerve. Dr. Bartholow also advises the following compound :

℞ Chlorate Hydratis,	
Camphoræ Pulv.....	āā 3j
Morphiæ Sulph.....	gr. ij
Chloroform.....	gtts. xl
M.	

To this atropia may be added after solution (which will be aided by gentle heat), in the proportion of about one twelfth of a grain to 3ijss, or to the amount in the above prescription. This combination may be painted upon the part in superficial neuralgia, or may be given internally in capsules, or diluted in water, in doses of from ten to thirty drops. Twenty minims of this solution will contain seven and a half grains of chloral, the same quantity of camphor, one fourth of a grain of morphine, and one ninety-sixth of a grain of atropia. A plaster of simple extract of belladonna, worn for some time over the painful part, will often procure decided relief.

A great variety of particular prescriptions may be found in the writings of different practitioners, and so many of them have already been referred to, because many cases are so obstinate as to tax the resources of the physician.

As a local remedy electricity is often efficient. The continuous current from a battery is generally used, and certain rules should be observed in its application. A low tension current should be applied ; the current with few breaks continued for some time, varying with the effects produced; and the positive pole should be applied to the

seat of the pain, while the negative may be applied to the origin, or in the course of the nerve, or elsewhere. Usually the current may be applied for about three minutes once or twice a day.

Certain surgical measures have been used for neuralgia when the pain is fixed in a certain locality and is obstinate and severe. Formerly acupuncture was advised—effected by the introduction of a needle as near as possible to the seat of the nerve, the penetration of the sheath being desirable. This, though sometimes affording relief, especially in sciatica, has fallen into disuse of late.

Section of the nerve, or dissecting out a portion, particularly in cases of obstinate facial neuralgia, is generally attended with much relief, which is often complete and lasts for months; but the pain is apt to return, and the operation has not the approval of all physicians. Anstie spoke disapprovingly of it. Its temporary benefits are so great, however, as to have justified its use.

If a source of peripheral irritation be present, such as may arise from the involvement of a nerve in a cicatrix or in a tumor, etc., surgical interference is demanded.

Of late the operation of “nerve-stretching” in neuralgia has attracted among surgeons much attention, and many reports have been made of its success. It consists in dissecting down to the trunk of the nerve, raising it upon an instrument and stretching it with considerable force. This method has not as yet been sufficiently tried to determine its comparative usefulness. At present it bids fair to be an important remedy. Very recent reports, however, indicate that Bilioth, who was a pioneer in nerve-stretching, has modified his views of its utility, and has to a large extent abandoned its use.

In the management of neuralgia, nothing is more important than to inquire into and remedy the morbid conditions of various kinds which are so often associated with it; and the general hygienic management cannot be of less consequence. Rest to the overworked, exercise and proper occupation to the indolent and those who devote themselves to watching their symptoms; bathing, fresh air, and often a change of locality; alternate sea and mountain air; regular habits and proper food and drinks; the avoidance of the habitual use of all articles which make an unnatural impression upon the nervous system, especially all the narcotic and semi-narcotic substances, are of essential importance.

LOCAL VARIETIES OF NEURALGIA.

So much space has been occupied in the description of neuralgia in general, that little need be said of its special local forms.

Neuralgia of the fifth nerves, or facial neuralgia, is one of the most common and severe forms ; but the principles of its causation and management are embraced in the general discussion which has taken place.

Diseases of the teeth and gums are not unfrequent causes of neuralgic pains in these parts, and the condition of these organs should always receive attention. The removal of the source of irritation will often relieve all the symptoms ; but teeth should not be needlessly sacrificed for such pain, and they should only be removed when they are hopelessly diseased.

In facial neuralgia the pains may be confined to the course and distribution of particular branches, such as the supra-orbital, the infra-orbital, the infra-maxillary, etc. When the supra-orbital is the chief seat of the pain there is intolerance of light, injection of the eye, and lachrymation. When it extends to the temples and side of the head it is called migraine and hemicrania. It is often called *brow ache*. When the lower branches are involved, spasmodic contractions of the muscles of the face sometimes occur, and the name *tic-douleureux*, or painful spasm, was formerly and is sometimes still applied.

A form of facial neuralgia persisting indefinitely, and coming on in paroxysms of pain, with spasmodic movements of the muscles of the face, has been spoken of as "epileptiform neuralgia." This is a peculiarly distressing form of the disease, and will justify surgical interference after other measures have failed.

Cervico-occipital, cervico-brachial, intercostal, lumbo-abdominal, and crural, have no characteristics other than those that have been mentioned that require particular notice.

A reflex neuralgia appearing under the breast, oftener the left, should lead to investigations as to a local but distant cause, and generally the pelvic or the digestive viscera or functions will be found in fault. The attention should be directed to these conditions more than to the painful part. A belladonna plaster, and other local applications, will often diminish the pain under the breast, though it will not remove the disease.

Visceral neuralgia has already been referred to, and in this connection needs only to be mentioned.

Cardiac, hepatic, gastric, periuterine (vaginal, ovarian), coccygeal, renal, cystic, rectal, and testicular neuralgia, each presents peculiarities of phenomena, but involves no principles other than those which have been described.

Sciatic neuralgia, or *sciatica*, may require a brief particular notice.

There are different varieties of this form of the disease. It may

occur in persons of nervous temperament, and in the female sex in connection with other neuralgias and with hysteria, chlorosis, morbid excitement of the sexual organs, and with pregnancy.

It more frequently, however, occurs in middle-aged persons, and much oftener in men than in women, and arises from muscular exertion, from exposure to cold and dampness. It frequently occurs in persons prematurely old, and in the alcoholic cachexia; and it is often obstinate and severe, not only inducing pain, but seriously interfering with locomotion.

Sometimes loaded bowels and tumors in the pelvis producing pressure coöperate with a predisposition and produce the result. The pains usually run down the course of the sciatic nerve and its branches, commencing in the spine or sacrum, thus showing more of a central than peripheral origin; and there is commonly diminution and sometimes loss of motor power; there are sometimes convulsive movements, occasionally anæsthesia. Pains in the sacral and lower lumbar regions are often spoken of as sciatic, and may be of a similar character to those described. In these forms of sciatica more painful and tender spots may be observed on the sacrum, over the sacro-iliac junction, about the middle of the ilium, at the sciatic notch, between the trochanter major and the tuber ischii, on the thigh along the track of the nerve, in the popliteal space, and at other points down to the sole of the foot.

A *third* variety of sciatica arises from inflammation in the tissues around the nerve, pressing upon it or involving it. This inflammation is generally rheumatic, syphilitic, or gouty. This form is not strictly or simply neuralgic, and most of the cases of sciatica are independent of any of these causes.

In none of the forms of sciatica is the pain as likely to be distinctly paroxysmal and periodic as in most other cases of neuralgia, and especially it is not as paroxysmal as in neuralgia of the face.

Diagnosis.—In the diagnosis of sciatic neuralgia it is to be distinguished from muscular rheumatism and from morbus coxarius. In muscular rheumatism the pain does not follow the course of the nerve, but is diffused in the muscles affected, and is excited into paroxysms only by motion of the muscles concerned.

Hip-joint disease is distinguished by pain in the socket, produced by pressure upon the trochanters, by striking the heel so as to jar the joint, and by flexion and other movements of the hip, etc. The general symptoms will differ, and the peculiar deformity of hip disease will in time appear.

The *treatment* of sciatica is to be conducted on the same general principles as in other forms of neuralgia, and details of remedies need

not be repeated. Rest in bed, however, in the early part of the attack is more important in this than in any other form of neuralgia. The disease is so apt to become chronic and obstinate, that the greatest quiet and most prompt treatment in the beginning is to be advised. In most of the cases of local neuralgia that have been mentioned, the disease is not entirely confined to the parts where it is chiefly located. Other nerves are also affected, and this fact will not only aid in the diagnosis but will indicate that the treatment is to be general and constitutional as well as local. Experiments show that injury of the sciatic nerve will produce morbid action in the cord and brain, and in other parts of the body. Neuralgic pains having their primary seat in the sciatic nerve may cause similar pains in other parts, which may cease on the removal of the primary affection. A disease, then, in this nerve, strictly local in its origin, may manifest morbid phenomena in other parts, so that local as well as general remedies will be indicated.

CEPHALALGIA.—HEADACHE.

Pain in the head is a frequent symptom of a great variety of diseases, as we have seen, and it is extremely common. To describe all the forms of the affection would take us back over a large portion of the ground we have traversed.

Cephalalgia as a more distinct affection, and not as a symptom of other forms of disease, is often neuralgic in character, and is due to morbid actions of the cervico-occipital nerves, or the supra-orbital division of the fifth pair. When confined to one side of the head it takes the name of *hemicrania* or *migraine*, and when superficial it is strictly neuralgic. But cephalalgia is by no means always of this character.

There are headaches that, so far as we can positively ascertain, come under none of the divisions of diseases which have been mentioned, and which may be regarded as distinctly *idiopathic* affections. The pain in these cases does not follow the course of the nerves, it is not attended by tender points, is not confined to one side of the head, is not of a fitful and darting character, and therefore these forms of disease do not present the characteristics of neuralgia. Though idiopathic headache produces more or less derangement of other organs, it seems not to be dependent upon them, as it appears to precede them and to be primary.

Symptomatic Phenomena.—The seat of the pain is often unmistakably deeper than the coverings of the skull; and in such cases,

when unilateral, as is sometimes the case, the pain has been supposed to be situated in the branches of the facial nerve which are distributed to the dura mater. It has also been supposed that the sensory filaments which enter into the composition of the brain are susceptible to a form of irritation, producing deep-seated unilateral headaches. However this may be, there are cases where deep-seated, heavy, and steady pains affect the whole head, or different parts not divided by the mesial line, but where the pain occurs more in the front, the back, or the middle portion, involving both sides alike.

These cases of functional idiopathic cephalalgia are not uncommon. The disease occurs in paroxysms lasting from a few hours to a few days, coming on usually at irregular intervals, and persisting in their occasional occurrence often for years, and sometimes for a whole lifetime. They, however, commonly cease, even after continuing for many years, on the approach of old age, and are uncommon in childhood.

The pain differs much in degree in different cases and in different attacks in the same person, sometimes not seriously interfering with the continuance of labor, bodily or mental, but at other times requiring the sufferer to take his bed. The pain differs in character as well as in degree. It is sometimes sharp and at others dull. Often patients complain of a feeling as if the head would burst, and a tight bandage about it gives some relief. At others there is a feeling of emptiness or vacuity. Frictions of the scalp in some cases are particularly grateful and give a degree of relief. Some of these headaches are accompanied throughout their attacks, but often toward the latter stage of the paroxysm, by nausea and vomiting, when they are called *sick headaches*, and are often spoken of as depending upon derangement of the stomach.

In a large majority of cases, however, the disease is neuropathic, and the primary seat is in the head, the disturbance of the stomach being secondary. When the stomach is not thus involved it is commonly called a *nervous headache*, which is not an inapt though a somewhat vague designation. In some cases the face is flushed, the eyes are injected, and the head is hot. In others the face is pale and the eyes sunken, and the head may be cold. There is rarely any general fever, the pulse is apt to be small and feeble, the heart may be irregular in its action, and a sense of coldness is not unusually felt. The appetite is commonly impaired or lost, but sometimes not; the bowels may be deranged, more commonly constipated; and the urine may be scanty, high-colored, and with much sediment, or it may be more abundant and pale. There is a constitutional predisposition to the disease which is not unfrequently hereditary, and some cases in their explosive recurrence remind one of epileptic affections.

Etiology.—In many cases no obvious cause can be assigned, though in women the attacks often occur near the menstrual period. The disease is more frequent in women than in men, and is often apparently brought on by mental exertion or worry, or by severe mental labor. In some cases, as in those of epilepsy, the attack leaves the patient gloomy, weak, and depressed, while in others a sense of relief and buoyancy of spirits follow a paroxysm.

The **Pathology** of this form of cephalalgia is obscure. As many toxic agents are capable of producing headache, the presence of poisonous matters in the blood, produced by malnutrition, malassimilation, or deficient excretion, has been suggested as the pathological condition. This suggestion has not, however, been sustained by proof.

Paralysis or spasm of the muscular fibres of the blood-vessels in the brain has also been suggested as the proximate cause; and the fullness of the vessels about the head in some cases, and the emptiness and pallor in others, have seemed to favor this theory. There is evidently something more than the mere increase or diminution of blood in the brain which gives rise to the attacks of pain, though either of these conditions may contribute to the suffering. The disease is neuropathic, and like epilepsy and hysteria is dependent upon some morbid conditions of the nervous functions which are simply not understood.

Treatment.—The radical treatment of periodical headaches is notoriously unsuccessful, and yet in some cases remedial measures seem to have the effect of eradicating the disease, and in a still larger number the attacks may be rendered less frequent and severe, and the suffering during them may often be abated.

The treatment is divided into that of the attack and that during the intervals. For the attack, a full dose of morphia or codeia will procure decided relief with some persons; and where the after effects are not unpleasant this treatment may be justified. In other cases a strong dose of tea or coffee will diminish the pain, though the continued use of these articles favors, and in some cases is alone sufficient to produce or keep up, the disease. At least their discontinuance by those who have used them freely will sometimes be followed by the cessation of the affection. The bromides, given in large doses at the early period of an attack, or in anticipation of its full development, are, on the whole, the most efficient and least objectionable of the remedies commonly used. From a scruple to a drachm of the bromide of potassium, or a corresponding dose of the other salts of bromine, repeated in a few hours if required, will often afford very material relief.

The hydrate of chloral in doses of fifteen grains, repeated if neces-

sary once or twice, will also often procure relief, but this must be used with more caution. The inhalation of chloroform or ether in a cautious manner, or of a few drops of nitrite of amyl, the latter especially where the face is pale, may be of service. Various other neurotic remedies, such as valerianate of ammonia, fluid extract of *nepeta cataria*, guarana, etc., will sometimes palliate the symptoms.

In the more congestive forms, saline cathartics, cold to the head, and hot pediluvia will be of service. When the stomach is evidently and early deranged, and in those cases usually ending in vomiting, that organ should receive attention. When there is acidity, alkalies may be given, and ammonia will sometimes afford relief by its stimulating as well as by its antacid effect. In some cases, by hastening the emesis by free draughts of warm water, or by a mild emetic, the paroxysm is brought to a more rapid termination. Some are relieved by the application to the head of a towel wrung out of hot water; and in many cases some of the forms of electricity—faradic or galvanic currents—will be found useful. This remedy is worthy of a fair and somewhat persistent trial. It is impossible to determine in advance what palliative remedies will have the most effect, and the severe suffering will justify the trial of various measures. Efforts may be made during the intervals to prevent the recurrence of attacks. No means which may have the effect to improve the general health should be neglected. In some cases the use of the bromides for a length of time will prolong the intervals, or prevent the recurrence of attacks.

Various other measures, such as the administration of *nux vomica* or *strychnia* in small doses, arsenic continued for some time, small doses of quinine, belladonna, the preparations of zinc, particularly the valerianate, may be tried. These several remedies sometimes appear to produce an effect. Hygienic measures should, of course, not be neglected. The abandonment of the use of coffee and tea, particularly when they have been used in free quantities, has in so many cases within my observation been followed by improvement that I can but urge attention to this means of avoiding this as well as other forms of nervous suffering. All particular causes, such as overexertion, mental worry, late hours, etc., should, as far as possible, be avoided.

NERVOUS EXHAUSTION.—NERVOUS ASTHENIA.—NEURASTHENIA.

These terms are used to indicate a debilitated and exhausted state of the nervous system, with more or less derangement of its actions, without anæmia or any special disorder of the nutritive or other

functions of the body, excepting those of the nervous system, and where the disorders of the system at large take none of the well-defined forms of neuropathic affections which have been discussed.

Patients are often seen who have no well-defined disease, but who complain of languor, low spirits, indisposition, or inability to apply themselves to active occupations. They are often wakeful during the night, and have a sense of fatigue in the morning. They have but little power of endurance of either physical or mental labor, and are often apprehensive of some serious disease. In many of these cases the mental, and in some the physical powers have been overtaxed. It is thought that more suffer from this cause in this country than elsewhere, something, perhaps, being due to the character of our climate, but more, probably, to the early age at which the duties and responsibilities of active life are assumed, and the vigor with which our occupations are pursued. The excitements of society and pleasure, no less than those of business and study, may produce this form of exhaustion; and the narcotic agents, taken for the purpose of "keeping up," contribute to the final failure.

Long continued, this form of morbid action may result in confirmed melancholy or insanity, and it disposes to other diseases. As the uncomfortable sensations accompanying this state are generally temporarily relieved by narcotics, habits of intemperance are apt to be formed, the suffering is thereby ultimately increased, and the sufferer ruined.

Great care and skill is often required in the management of these cases. Much mischief may be done either by neglect or too much "cod-dling" treatment. Rest from overexcitement and excessive labor, for a time, is essential. But the complete and permanent abandonment of study or business, encouraging the notion that the patient is "broken down," or that his powers have permanently failed, would be a serious mistake—might, indeed, be ruinous to an active and useful life. "Broken-down" professional men often become useless or worse than useless members of society by wrong advice as to the relinquishment of their occupation. After reasonable rest and recuperation, and perhaps after a change of scenes and climate, accustomed labors should be resumed, moderately at first, and often the former power will return. A short rest, or abatement of labor, a temporary change taken in time, will prevent an exhaustion which, without such timely relaxation, may be more permanent.

The great remedy in these cases is comparative or temporary rest, some agreeable change, and obedience to hygienic rules. There should be an assumption of, or a return to, a simple and natural life, accustomed narcotics must be abandoned, the debilitating and derang-

ing use of tobacco and alcohol particularly should be avoided, and plain, wholesome, nourishing food should be taken, for a time in moderate quantity, and afterward more freely. Sea bathing, out-of-door life, mountain air, and sometimes systematic hydro-therapeutic measures will be useful.

Tonic medicines, varied from time to time, such as preparations of phosphorus, bitters, strychnia in small doses, moderate doses of quinine, etc., will often have a beneficial effect, operating upon the mind as well as upon the body; but they should not be continued too long, nor should too much reliance be placed upon them.

I fully agree with Prof. Flint, that at the present time there is a tendency to exaggerate the pathological relations of the neurasthenic morbid conditions. "No anatomical system in the body tolerates functional activity better than the nervous system, provided the organism is sound and the requirements of health in other respects are observed. Patients are sometimes disposed to attribute to overexertion of the mental faculties what is really due to other violations of the laws of health. The opinion that the symptoms denote excessive brain work is apt to be received with satisfaction. In some cases, considering the small amount of intellectual work accomplished, and the limited capabilities of the brain, this opinion seems ludicrous." My own observation has, to a large extent, been among students. I have seen some exhausted and injured by excessive application and overstrain in intellectual labor, but I have seen many more injured by *improper indulgences*, the use of tobacco, want of exercise, insufficient or improper food and drinks, not unfrequently combined with intellectual indolence. Good, active brain work tends to health and longevity. Very few persons are injured by intellectual labor who are obedient to general hygienic laws.

TREATMENT OF NEURASTHENIA OR CHRONIC EXHAUSTION, EMACIATION, AND INVALIDISM, BY REST, FOOD, AND MASSAGE.

In cases of nervous exhaustion and disorders in women, often combined with hysterical manifestations and sexual derangements, the method of treatment, as brought to professional notice by Dr. Weir Mitchell, in his work entitled "*Fat and Blood, and How to make Them*," is worthy of attention.

This mode of treatment is said by Prof. Playfair, of London, to be particularly applicable to those severe cases where often the patients are confined to the house or their beds, where there is wasting of the fatty tissues combined with anæmia, loss of appetite, and refusal of a proper amount of food; where there are marked dyspeptic symptoms,

which are often aggravated by chloral hydrate, morphine, or alcohol ; where there is a morbid craving for sympathy, and where, from personal suffering, an invalid selfishness is often developed which victimizes their attendants, their family, and friends. It consists in removing the patient from the unwholesome moral atmosphere which surrounds her, combined with the renewal of her vitality by free feeding, the assimilation of the large quantity of food being made possible by passive muscular exercise produced by the systematic use of shampooing and electricity. The plan involves four principal means :

First. Seclusion and rest. There must be entire seclusion of the patient from her family and friends, under the care of a trained and competent nurse, who will exercise a control which sympathizing friends cannot. This is essential. The patient must then be put at rest in bed, and temporary absolute repose must be enjoined, and obedience and order insisted upon. She is not allowed to read or sew, nor to rise, except as necessity demands. Gradually the periods of this repose are lessened ; she is required to sit up after a time for several hours, and toward the end of the "cure" she rests on the bed only for a few hours during the day.

Second. The next item of the treatment is *massage*, or *systematic shampooing*, and exercise of all the muscles, both of the extremities and the trunk, first for about half an hour twice a day, but very soon for not less than an hour and a half, night and morning. The patient expends no nerve force in this exercise, as it is entirely passive. This massage should be performed by a trained "rubber." However much hysterical tenderness there may be at first, the patient soon endures, and then enjoys the kneading and rubbing.

Third. Electricity forms a valuable subsidiary means. The interrupted current is employed twice a day, from half to three quarters of an hour. The poles, armed with wet sponges, are applied about four inches apart over the muscle to be excited, and are slowly moved until the muscle is made to contract freely. Commencing at the feet, the whole body, except the head, is subjected to the process. The utility of this part of the process is particularly shown in those cases where hysterical paralysis has long existed.

Fourth. The diet and regimen is the *most essential* part of the treatment. The patient, as soon as the treatment commences, is placed upon a diet of milk alone, given at intervals of three hours. At first three to four ounces are given at each feeding ; but in two or three days the amount is increased to eight or ten ounces, so that in three or four days she is consuming two or three quarts of milk in the twenty-four hours. The dyspeptic symptoms are said to rapidly disappear under this feeding. When the massage commences, which

should be in a few days, bread and butter and an egg are added ; then in two or three days a chop, finely cut up, with some vegetables, for the midday meal, and so on, continuing the milk and adding various other articles—soups, meats, fish, vegetables—feeding eight or ten times a day, so that astonishing quantities are consumed !

I cannot doubt that modifications of this plan will be made, and the extreme feeding will be found at least unnecessary, if not in many cases injurious ; and it will be found impossible to carry out these rigid measures in not a few cases ; but the reports of success have been so many and so well attested, that it has been judged proper to give a brief sketch of this mode of treatment. The change of associations and surroundings, the enforced regulation, the mental control, the passive exercise, and the free diet, it cannot be doubted, will often have a great effect in breaking up morbid habits and restoring lost vitality.

INSOLATION.—SUN-STROKE.—COUP DE SOLEIL.

These terms are applied to a severe and dangerous prostration produced by excessive heat, and commonly by the direct rays of the sun.

Symptoms and Course. — Though sometimes preceded by symptoms, such as thirst, an oppressive sense of heat, dryness of the skin, vertigo, congestion of the eyes, and labored breathing, these are sometimes wanting and the attacks are very sudden. When the characteristic symptoms occur, the patient is speedily prostrated, often falling down as from a stroke of apoplexy, with loss of consciousness ; with a variable pulse, sometimes full, but later with diminution of the heart's action ; with labored, oppressed, or diminished respiration ; and not unfrequently these conditions are followed by sudden death. Before consciousness is lost, or in milder cases where the loss of consciousness does not occur, there is apt to be pain in the head, a sense of fullness and oppression in the epigastrium, sometimes, though in my observation rarely, nausea and vomiting, generally a feeling of weakness, more marked in the lower extremities ; dimness of vision, vertigo, mental confusion, and more or less loss of sensibility. Accompanying the dimness of vision, in many cases all objects appear of a uniform color, sometimes purple, at others red, and at others white. In some cases convulsions occur, and not unfrequently there is rigidity of certain muscles ; and in the later stages a sense of coldness is sometimes experienced. Generally, as tested by the thermometer, the temperature is decidedly elevated, in rare cases as high as 110° F. When the thermometer shows a rise to 107° and upward, a fatal ter-

mination may be expected, at least unless the temperature is speedily reduced. Vomiting and purging, when great, are unfavorable indications. The duration varies from a few minutes to several hours, when in the favorable cases the patient emerges from the comatose state, and convalescence is usually speedy, though some impairment of the brain is often for a long time left behind. A temporary paralysis sometimes follows, and I have seen a few cases of more permanent paralytic affections which were attributed to the patients being overcome with heat.

Varieties.—In the fatal cases death sometimes occurs from syncope, sometimes from apnœa, and sometimes from coma; often from these different conditions combined. The cases terminating most speedily from syncope are spoken of as of the cardiac variety, while those accompanied with insensibility, stertorous breathing, or convulsions, are regarded as the cerebro-spinal. All the organs are, however, more or less involved, though some more than others in the different cases.

Morbid Anatomy.—When death is as speedy as it commonly is, there is not time for much structural change; but some congestion of the cerebral vessels is common, and the lungs are generally congested, particularly in the cardiac varieties, and the right side of the heart is distended with blood. Hemorrhages are sometimes found in the lungs, and œdema not unfrequently; and there may be serous transudation into the pleural and pericardial cavities, and into the ventricles of the brain. As a large proportion of those dying from sun-stroke are intemperate persons, or at least users of alcohol, cloudy swelling of the kidneys, and parenchymatous degeneration of those organs, and also of the liver, spleen, and heart muscles are not unfrequently found.

The blood is said to be uniformly found in a fluid state, and is dark and accumulated in the large veins. It resembles the conditions of the blood found in death from lightning, and from blows upon the epigastrium.

Pathology.—Various experiments have been made upon animals, producing death by specially exposing them to sun heat, as well as observations upon many human subjects, to determine the special pathology of the affection, but they have not been satisfactory in leading to very definite knowledge. The most that can be said is, that a certain degree of heat produced by the rays of the sun is incompatible with proper cerebral action, and that some brains can endure less elevation of temperature than others. The blood is also changed; and in the cases not proving too speedily fatal, some of the phenomena of fever manifest themselves.

Etiology.—As to the cause, *heat* is the chief agent in producing the phenomena of insolation ; but other factors operate in the production of the result. Muscular exertion unduly great or prolonged, especially after a meal when the energies of the system are engaged in the digestive process, the free use of alcohol, and various disturbing and exhausting conditions render the system more susceptible to the action of the chief agent. Certain other atmospheric influences than heat, such as dryness or moisture, and electrical states, are supposed to have an influence ; but facts are wanting to show whether influences of this kind have an effect, and if so, what they are. It is certain that with the same degree of heat more cases occur at one time and season than at another.

Although the direct rays of the sun are generally concerned, cases have occasionally occurred with soldiers in their barracks and in the night, and cases have also occurred in laundries, sugar refineries, etc.

Diagnosis.—The distinguishing of sun-stroke is not usually difficult. The temperature of the place and the patient, the manner of attack, etc., will be sufficiently diagnostic.

A case, however, might be confounded with apoplexy, with drunkenness, with syncope, with hysteria, and with simple exhaustion from overexertion combined with the ordinary debilitating effects of heat. Soldiers, and even officers, are said to have feigned sun-stroke, and to have deceived their commanders ; but a physician would readily detect the imposition.

Prognosis.—This is grave. Of the severe or well-marked attacks from forty to fifty per cent., and even more at some seasons die. The more unfavorable signs are prolonged and complete insensibility—and the danger is greater when there is no movement than when there are occasional spasms—intense heat, notwithstanding cold applications, irregular action of the heart, and failing pulse ; and great lividity of the extremities is also unfavorable. Convulsions appearing after considerable continuance of severe symptoms are usually soon followed by death.

Treatment.—*Prophylactic* management is important, particularly in military expeditions in hot climates and seasons. W. C. Maclean, M.D., of the British army in India, advises the avoidance of drill and of marching when the heat is great, the supplying of plenty of tents to avoid crowding, light and loose clothing and accoutrements, protection for the head, and an extra supply of water not only for drinking but also for douching, marching in open order, and making frequent halts. Regarding the matter as so fully demonstrated, he says : “ Nor is it necessary to say much of the good effects of temperance. It is to be hoped that the day is not distant when

the spirit ration will be a thing of the past." (Reynolds' System of Med.)

As the pathological conditions vary in different cases, the best treatment of attacks cannot always be the same. In case of evident cerebral congestion, Dr. Flint is of the opinion that blood-letting may be indicated. He is very positive in the expression of the opinion that in what he calls well-marked apoplectic cases blood-letting is the measure especially called for. He says the life of the patient may depend upon its prompt employment. At the same time he advises that the bowels be freely opened with croton oil, and, in short, the same means used as in congestive apoplexy. The condition, however, is that of *irritation* and failure of functional activity, rather than simple congestion, even where congestion is an element, and as a very general rule certainly, bleeding is contra-indicated. I am not prepared to say, however, that blood-letting should never be used; but in my own experience in the disease, which has extended to a considerable number of cases, some of them in the Army of the Potomac among new recruits from the North, at an early period of our late war, I have never seen a case where I thought it would be justifiable. A very plethoric man may without injury lose a portion of his excess of blood under almost all circumstances, even of exhaustion and depression; but unless positive plethory exists, bleeding, certainly as a rule, should be avoided.

The first object of treatment is to reduce the temperature, which is the cause of the suffering. The patient should be placed in as cool a place as possible, he should be at rest, every restraint to the circulation should be removed, and cold, in the form of a douche or of ice, should be applied to the head especially, and to the body generally. This may be best done in some cases by wrapping the body in a sheet wet in cold water, and pouring water frequently over it, keeping this up until the temperature is reduced or as the symptoms may indicate.

Injections of cold water may, at the same time, be thrown into the bowels. The patient should be encouraged to drink freely of cold water, and if vomiting is induced by it, relief rather than injury will be the result. Should the bowels be moved by the enemata given, the effect will be beneficial. These internal as well as the external cold applications should be continued until the temperature is brought near the normal standard.

The next object is to soothe the irritation, which I believe to be the predominant condition.

For this purpose I have found nothing so effectual as the placing from a quarter to half a grain of morphine far back upon the tongue, and giving a sip of water soon after. A hypodermic injection of an

appropriate dose would doubtless fulfill the indication more promptly and certainly, but my experience has been with the morphine upon the tongue, and I cannot speak too confidently of its good effects. Certainly where soldiers fall down from the effects of the heat and the excitement and exertion of a march or a battle, they will often be almost immediately restored by half a grain—and often more effectually by two thirds or even a grain—of morphine put upon the tongue. In that state of irritation and excitement very large doses will be borne in a strong unimpressible man without producing narcotism. Shock and irritation will be relieved, depression overcome, and the prostrated man will, in many cases, “take up his bed and walk.” In the more severe and decided cases of insolation I have seen the most striking relief obtained from this treatment.

Dr. Maclean, whose experience in sun-stroke in India was large, advises *Warburg's tincture*, which it is thought is composed chiefly of quinine with some aromatic and diaphoretic articles. This reduces the temperature and produces diaphoresis; and lately quinine in free doses has been given with alleged good effects, reducing promptly the high temperature and restoring more normal action.

I cannot doubt from what I know of insolation and of the action of quinine that its effects are very beneficial, though I have not had experience with it in such cases. Should a case at the present time come under my care I should not hesitate, among other measures, to administer free antipyretic doses of quinine and morphine, in many cases hypodermically.

Dr. Maclean says that in India he and Dr. Barclay have found the inhalation of chloroform of great service in the convulsive forms of the disease attended with great nervous irritability. In some of these cases the douche is not well borne. When the heart's action fails, ammonia, camphor, and other stimulants will be indicated. When the stomach rejects them, they may be administered by enema or hypodermically.

Counter-irritation, as by sinapisms, will tend to relieve the internal congestion, and friction as well as irritants may be applied to the extremities when they become blue or pale and shriveled from deficient circulation. Even warmth may be applied to them, if in the application of water they become cool, while cold is still applied to the head and trunk. It is an object to equalize the circulation. Quinine tends to effect this object, and probably this is one mode of its operation in producing the beneficial effects which recent reports have attributed to it. Dry cups to the chest and along the spine, and, where evidences of internal congestion are marked, ligation of the extremities may be useful.

Under proper management many recover from sun-stroke completely, especially from its milder forms ; but others are incapacitated by it for longer or shorter periods. Partial paralysis, as has been mentioned, sometimes results, and in other cases persistent headache follows.

In these cases *eliminative cathartics and diuretics, and the bromide and iodide of potassium* are the most successful remedies. Increased vascularity, nutritive changes with exudations, probably of a slow inflammatory character, doubtless take place, requiring the treatment just indicated. At any rate this treatment has, in a number of cases which have fallen under my care, been markedly successful where the previous use of tonic remedies had failed to give relief, or had aggravated the symptoms. An illustrative case was presented in the Michigan University Hospital, in a man of former full habit, aged forty-three, who some months before had been "overcome with the heat." He was so far paralyzed as to be unable to walk, and was brought into the amphitheatre on a stretcher. Both the upper and lower limbs were affected, but the right side more than the left. A rigid contraction of the muscles of the jaw prevented the opening of the mouth and the act of mastication, and he was fed by having food pressed between his teeth. He had frequent epileptoid convulsions, most upon the right side, lasting a few minutes, sometimes two, three, or four times a day, but only occasionally was consciousness entirely lost. He spoke with difficulty, and the saliva was not controlled. He had suffered from much pain, and a still greater sense of confusion in his head ; but his intellect, though weakened, was not materially impaired. His pulse was rather full, and his face and eyes had a somewhat congested appearance. He had been treated with strychnine and other tonics, but had grown worse up to the time of his admission.

He was put upon four-grain doses of blue mass, with fifteen grains of bicarbonate of soda, each night, followed by a saline cathartic next morning. This was continued for four or five days, when he took a scruple of bromide of potassium, with seven grains of iodide of potassium, three times a day, with an occasional saline laxative. He had lived in a malarial region, and in about two weeks after his admission he was attacked with malarial chills and fever. These were speedily interrupted by antimalarial doses of quinine, and the bromide and iodide were resumed. His symptoms from the beginning of the treatment abated, and in about four or five weeks he returned to his home ; soon after this all his symptoms disappeared, and he has remained well since, now nearly three years.

Epilepsy sometimes follows sun-stroke, and under proper treatment

the prognosis is generally favorable. In some cases the impairment of the brain produced by insolation is permanent, and especially a liability to be prostrated by heat continues. Attention to hygienic conditions, to the functions of the bowels, the kidneys, the skin, etc., will be required, and a residence in a cooler climate is desirable.

EPILEPSY.

This is a peculiar disease of the nervous system, characterized by paroxysmal explosions of nervous force in which various morbid phenomena occur. In these abnormal phenomena both psychical and physical elements are observed; the first consisting of mental aberrations and usually of unconsciousness, and the second of motor disturbances, usually convulsive.

The name epilepsy, from the Greek, indicates a seizure, and various modern synonyms, such as the common English, falling sickness, the German, fallsucht, the Italian, mal caduco, indicate the most striking symptomatic phenomena of the disease—the sudden attack with its prostrating result. A disease so striking in its characteristics was naturally recognized by the earliest writers on medicine, and was then called by various names. The Romans called it *morbus sacer*, probably because it was regarded as a supernatural visitation—produced by evil spirits—and was to be remedied by divine rather than by any human power. It was also called *morbus commitialis*, because it often occurred in their crowded assemblies, and when it did so the meeting was immediately dissolved.

All these names have reference to the disease in its fully developed and severer forms. Modern science recognizes two chief divisions of the affection—*epilepsia gravior* and *epilepsia mitior*. or, as often expressed in French, the *haut-mal* and *petit-mal*.

The great fit, or the graver attack, is the form most terrible to patients and friends; but the small fits, or slight attacks, are quite as grave in their significance, and are very generally followed or accompanied by occasional occurrences of the more appalling form.

The symptomatic phenomena of this form will first be described, and afterward the slighter attacks; and some irregular forms, as *masked epilepsy* and *hystero-epilepsy* will be noticed.

EPILEPSIA GRAVIOR.

The common epileptic fit has been regarded as having four stages: 1. A premonitory stage; 2. A stage of spasm or convulsion; 3. A

stage of subsidence ; and 4. A stage of stupor. The first of these stages is not unfrequently absent, the convulsion coming on with the utmost suddenness ; and the fourth is not always well marked, as the patient sometimes nearly as suddenly comes out of the fit with only some confusion of mind and feelings of languor. '

In an ordinary full attack, whether with or without premonition, the patient suddenly becomes deadly pale, a tonic spasm seizes the whole body, he falls to the ground, often forward ; the head is generally drawn to one side, the eyes are open or turned upward, the pupils dilated and fixed, and the breathing is interrupted by spasm of the larynx and respiratory muscles. The pallor of the face soon yields to lividity, a labored and interrupted breathing occurs, clonic spasms or convulsions take the place of the tonic rigidity, the tongue is often bitten, breathing through the closed teeth generally causes frothing at the mouth, often bloody ; the extremities are agitated, often violently ; the face is drawn into hideous grimaces, the muscles of the neck stand out, the veins in this region are turgid and the carotids throb, though the pulse at the wrist is at first weak and fluttering. The tonic spasm continues from a few seconds to half a minute, and the clonic general convulsion continues from one to three or four minutes, very seldom much more, though to the bystander the time may seem longer.

The stage of subsidence then occurs ; the convulsions cease, the breathing becomes more regular, though heavy and puffing, and the stage of stupor or a deep comatose sleep usually supervenes, lasting from a few minutes to a much longer period ; the patient then awakes in a state of some mental confusion, but at length consciousness is fully restored with a realization of the situation. The congestion of the face may be so great during the struggle as to leave marks of extravasated blood about the eyes or on the forehead.

An essential element in all decided epileptic attacks is unconscioness ; and this distinguishes the convulsions from some forms of hysteria where a degree of consciousness usually continues.

At the time of the seizure a peculiar cry is commonly, though not always, uttered, which by its terrific quality adds to the horrors of the attack. It is between a scream and a groan, varying in different cases, and though usually more terrible, may in some instances be compared to the cry of a young lamb. When the cry is absent there is usually a fixed stare, and at the moment of the cry or the stare consciousness is lost.

One side of the body is often more severely convulsed than the other ; and sometimes during the fit evacuations occur from the bowels, the bladder, or the seminal vesicles. As the convulsions

cease the patient may become partially or confusedly conscious, looking about, and afterward passing into a sleep or a comatose state which continues half an hour or longer. Oftener the comatose sleep is continuous with the convulsions, the unconsciousness not being interrupted until the wakening from sleep. In other cases, as the patient comes out of the fit, and sometimes at other periods near the paroxysms, there will be maniacal excitement, usually tending to violence. A sudden blow may be struck and other dangerous acts committed. Sometimes hallucinations of sight or hearing occur, and other mental abnormalities are observed.

Epileptic seizures may take place during sleep or in the waking hours, but more frequently in the latter. Some always have their attacks while awake, others always when asleep, while others still are sometimes attacked at different times, both during waking and sleeping.

In the stage premonitory to the full attack various sensations are experienced, and sometimes objective phenomena are seen.

An *aura* is sometimes felt, or a sensation of a peculiar kind, sometimes resembling that of cold air blown upon the surface, commencing at a particular part, oftener perhaps at the epigastrium, but sometimes at the extremities and in other parts of the body, passing up to the head, when the fit commences. This is, perhaps, much oftener felt than remembered, as various occurrences just before the loss of consciousness are often forgotten. Other sensations may be experienced for a considerable time before the attack, such as pain in the head, or a sense of confusion or apprehension, or vertigo, or a feeling which is entirely indescribable. Sometimes the face and eyes are observed to be altered in their expression before an attack, and various changes in the mental state may be noticed. But it would be vain to attempt to describe all the symptoms which may appear in different cases. Epilepsy in the symptomatic phenomena of a single fit is scarcely distinguishable from what has already been described as *eclampsia*, and, indeed, it has been proposed by Nothnagle (and the idea is encouraged by Dr. E. C. Seguin) to consider eclampsia as an acute epilepsy, the distinction between the two being that eclampsia arises from different causes—temporary irritations, toxic or uræmic conditions—while true epilepsy is a chronic affection, an organized or recurring form of disease depending upon a peculiar condition of the nervous system, the exact nature of which is not fully understood. The difference between eclampsia and epilepsy is similar to that between delirium and insanity. In both of the last-named affections there are unsoundness of mind, morbid impulses, and intellectual delusions; but in the one the causes are temporary and apparent, depending on other morbid conditions; in the other the causes

are more permanent in their effects, and the phenomena are more idiopathic, systematized, and persistent.

EPILEPSIA MITIOR.

Besides these phenomena of the *grand-mal*, or epilepsy gravior, the *petit-mal*, epilepsy mitior, has its peculiar symptoms. In these attacks there may be *momentary unconsciousness without marked spasms*, or *unconsciousness with some local spasms*, or *abortive paroxysms*. In the first class of cases the patient may stop in the midst of some occupation or conversation, remain inactive or silent for a few moments, with a blank expression of the countenance or a vacant stare, when immediately the occupation or conversation may be resumed as though nothing unusual had occurred. In other cases there will be confusion of thoughts and actions for some little time, and sometimes strange acts will be performed. Soon, however, all will be over, and the usual course of thought and conduct will be pursued.

To this state of temporary unconsciousness some spasmodic contractions may be added. The head may be turned to one side, or bent forward, the face may be drawn, each with a steady or jerking motion; a limb or other part of the body may be agitated, respiration in some degree interrupted, an act of vomiting may be excited, or a more general but slight agitation of the body may occur.

Sometimes all the premonitory symptoms of a severer fit may come on, the aura may be felt, the patient may cry out, may stagger or possibly fall, but the usual fully developed phenomena will not take place, and the paroxysm will be aborted. This result may be produced by dashing water upon the face or neck, by the inhalation of ammonia, or by some other means which will make a strong impression upon the sensitive nerves; or it may be produced by a determined effort on the part of the patient, his consciousness not being destroyed, or it may occur spontaneously. In some cases the patient rushes about for a short time, or performs extravagant and unbecoming acts, these conditions continuing about the same length of time as other paroxysms.

There are very different degrees of these abnormalities; sometimes the paroxysms are so slight, the phenomena so entirely subjective, as not to attract attention. It will be observed that in a typical case there are different orders of phenomena; there are disorders of intelligence, of sensation, and of motion, which in severe cases seize the

patient simultaneously, but in less severe forms they follow each other, while in the slight attacks only one or two of these orders may be manifested.

I have seen several cases in boys from ten to fifteen years of age, where occasional paroxysms of vomiting occurred, which could be accounted for in no other way, and which I regarded as epileptic in character. They yielded to a somewhat prolonged course of bromide of potassium, this result having tended in my mind to confirm the diagnosis.

HYSTERO-EPILEPSY.

Hystero-epilepsy is a somewhat distinctive form of disease, in which there is a commingling of the hysterical and epileptic elements resulting in a variety of phenomena of a very striking character. Some forms of this compound affection have been extensively observed and carefully studied by M. Charcot. A remarkable similarity in the course of the paroxysms has been observed in the cases which have been for a long time under his treatment in the same wards in the Salpêtrière Hospital; but just such cases have seldom been observed elsewhere, and I cannot doubt that the principles of sympathy and imitation have had much to do in producing these results.

In these cases the attacks are more or less frequent in occurrence, sometimes observing a degree of periodicity, coming on once in from one to several weeks, the morbid excitement lasting from a few hours to a few days, during which time repeated convulsive paroxysms take place. During the fit there is partial, and sometimes complete loss of consciousness; but in the evolution of the paroxysm various abnormal mental states are observed, following, in M. Charcot's cases, a certain order. The most striking physical manifestations are the convulsions. Varied grimaces with tonic and clonic contractions of different parts of the body succeed each other, the limbs are drawn in different rigid positions, the paroxysms coming on one after another, often in quick succession, each lasting from a few minutes to a much longer time. The general attack at length subsides, with less effect upon the system than might be supposed from the violence of the exercises.

These fits occur in females, and are much controlled by firm and continued pressure over the ovaries.

When hysteria is a prominent element in a disease the symptoms are much varied, and it is impossible in any reasonable space to describe all their protean forms.

Various *complications* of epilepsy occur. *Epileptic mania* has

already been referred to as sometimes preceeding and following the paroxysms. This was described as generally furious and dangerous, but it is not always so. It may be gay and eestatic, or dull and melancholy; and cases occasionally occur where more persistent forms of insanity accompany the epileptic condition.

Idiocy is not unfrequently complicated by epilepsy, the same cerebral lesion or insufficiency producing the idiocy disposing to epilepsy.

Paralysis, contractures, and other pathological states may complicate cases; sometimes both affections appear to arise from a common cause, while at other times they are simple coincidences, though they have more or less influence upon each other.

Meningitis has been known to follow epileptic attacks, but this event is not common, and only requires this mention.

Apoplexy is often feared as a consequence of the violence of the epileptic convulsions, but experience proves that it is very rare as a consequence, and there is very little reason to fear its occurrence.

The *consequences* of epilepsy upon the body and the mind vary much in different cases. Some continue in good bodily health for long periods, with mental powers but little impaired. Julius Cæsar and Napoleon were epileptics, and others who have been distinguished for great abilities have suffered from occasional attacks of the disease; but epileptics usually have some eccentricities of character; and some, either from the continuance of the disease or the concomitant conditions, have serious mental and physical impairment.

PATHOLOGY OF EPILEPSY.

The pathological nature of epilepsy, it must be confessed, is surrounded with much obscurity. The *pathological anatomy* of the disease is still at fault; for although a great variety of lesions have been discovered in epileptics, there is no such uniformity as will justify positive conclusions on the subject, and indeed there is no one organ or part of an organ which is uniformly found to be affected, and in some cases all the organs, so far as detectable, are in a healthy state. Space will not allow the mention of all the lesions that have been found in different parts of the body, and that have been supposed to exert an influence in the production of the disease, or to have certain pathological relations with it. These lesions have of course been most sought for in the brain and upper part of the spinal cord; but it seems that an injury or irritation in any part of the nervous system, central or peripheral, may tend to the production of the disease. There is, however, something back of all these lesions, a general constitutional state, the nature of which is not understood.

Among the conditions which have been discovered, and are supposed to have an influence in the production of the epileptic phenomena, are: "considerable dilatation of the vessels, especially in the posterior half of the medulla oblongata, extending from the fourth ventricle to the hypoglossal and pneumogastric nerves or olivary bodies;" "unsymmetrical development of the olivary bodies, asymmetry of the medulla;" "constriction of the spinal canal, with secondary atrophy of the medulla oblongata" (Rosenthal); induration of the cornu ammonis or pes hippocampi; induration of the white matter of the hemispheres; disorganization of a granular character of the nerve elements of the medulla; osseous growths pressing upon nerve-centres; spicula of bone penetrating the brain; vascular anomalies; cysts; tuberculous deposits; softening of brain substance; lesions of the cord and certain spinal nerves, etc.

Changes in the contour of the skull, thickened and calcareous meninges, increase in the weight of the brain, diminution in its weight, tumors of the cortex, irregular distribution of gray matter, and very often in old cases fatty changes in the vessels, hyperplasia of connective tissue and atrophy of the cells in the brain and ganglia, thrombosis, obliteration of vessels and sinuses, laceration, and still other changes have been found; but similar changes have also been found in other cases, and the constant connection of any of these with epilepsy has not been shown.

Numerous experiments have been performed upon animals, and the artificial production of various lesions by Dr. Brown-Séquard has resulted in making epileptics, particularly of guinea-pigs; and blows upon the heads of these pigs, injections of absinthe in dogs, inducing hyperæmia of the medulla oblongata and other parts of the brain and cord, have caused epileptic convulsions. Dr. Brown-Séquard has observed contraction of the vessels of the cerebral pia mater in epileptic animals; and others have shown that irritation of peripheral nerves causes contraction of cerebral vessels, and it is supposed that in this manner peripheral irritations cause epileptic seizures.

But, as already stated, epilepsy occurs where none of these conditions have been shown to exist, and the pathological anatomy is unsatisfactory.

The present prevailing theory as to the *nature* of epilepsy is that there is an *exaggerated excitability of the medulla oblongata*, and, according to Schroeder van der Kolk, this is always associated with dilatation of the vessels of this organ and its neighboring parts.

There is probably always more or less change in the calibre of vessels in an epileptic attack. The face in the beginning of the attack is pale, and the arteries of the brain are believed to be contracted. The ves-

sels of the face later in the attack become turgid, and venous stasis in the brain is probably present. Both contraction of arteries and passive dilatation of veins result in diminished circulation of oxidized blood in the brain, and produce the effects of anæmia. The loss of consciousness and beginning of the spasms are coincident with cerebral anæmia, and are thought to be produced by that condition; and it is averred by Rosenthal that the loss of consciousness and the insensibility have their origin in the cerebral hemispheres, while the convulsions originate in the excitable region situated behind the optic thalami.

Solly's theory of arterial congestion as the essential condition is clearly untenable, since convulsions so frequently occur in anæmia, and in epilepsy the face is deadly pale at the commencement of the paroxysm. That anæmia, however, is not the sole condition of convulsions has been demonstrated experimentally by showing that they occur sometimes when the brain is filled with blood. Marshall Hall attributed the principal part of the production of the phenomena of epilepsy to spasms of the muscles of the neck and the glottis, interrupting respiration. But these spasms are a part of the phenomena, and not always the first in the series.

That convulsions may be produced by spasms of the cerebral arteries and consequent anæmia of the brain may be true, but there must be something that causes the spasm of the arteries, and that something may produce the general spasms.

Fothergill says: "The thorough investigation of the vascular relations of epilepsy has done away with the theories which made epilepsy rest upon circulatory disturbances. The fit itself is an explosion of nerve energy in overcharged or unstable nerve-centres." (Handbook, p. 748.) This may be true, but the expression "explosion of nerve energy" is not altogether satisfactory as an explanation of the phenomena. That there is a peculiar morbid excitation is certain, but attempts at its explanation are simply conjectures. That there is a morbid condition of the brain and nervous system, perhaps chiefly of the pons Varolii and medulla oblongata, in which excitability reflex and direct is increased, seems reasonably clear, and that is as much as can be said, in the present state of our knowledge, as to the nature of epilepsy.

There are more speculative opinions than demonstrated facts connected with all these statements respecting the nature of epilepsy, and until the doctrines of localization are more clearly defined and better established than at present, a degree of skepticism on the subject is not to be condemned.

It may, however, be accepted as probable that a vaso-motor neu-

rosis of the brain exists in an epileptic attack, that a vascular spasm starts from the vaso-motor centre, rapidly becomes more general, and causes cerebral anæmia, thus obstructing the reciprocal exchange of influences which normally transpire between the blood and the brain.

It is probable that the seat of the primary central derangement is the medulla oblongata and upper part of the spinal cord, and that at the origin of the vaso-motor nerves there is an increased and perverted readiness of action, causing contraction of the vessels supplying the brain and other parts; that this leads to the arrest and perversion of function, including the arrest of breathing and an asphyxiated state, which promotes the continuance of the convulsions; and that blood poisoning from the retention of carbonic acid and absence of oxygen plays a part in the production of the subsequent symptoms.

In some cases epilepsy appears to be *idiopathic* and *central*—the primary changes, the starting-point of the disease being in the nerve-centres and existing alone—and may be transmitted by heredity, while in other cases it is *symptomatic* and *eccentric*, dependent upon disease or irritation of the periphery, though it may be induced by conditions acting upon the nervous centres directly, such as mechanical injuries, insolation, excesses, etc.

A case commencing in peripheral irritation may become central, a change in the central organs having occurred and an epileptic habit being established, so that the disease continues after the exciting cause is removed.

Admitting the correctness of all these positions, the essential cause of the epileptic condition remains unexplained, and is involved in profound obscurity.

Etiology.—There are, however, particular conditions which promote the occurrence of epilepsy and excite paroxysms when the epileptic constitution exists.

Hereditary taint exists in a certain proportion of cases, the parents or grandparents having had the disease or some other forms of nervous affections. The offspring of the insane, of the intemperate, the neuralgic, etc., are more liable to have epilepsy than the children of healthy parents; but the causes of the disease oftener originate in the individual. Too exclusive a search after a hereditary cause may divert attention from causes that may be removed.

Sex has but little influence upon the production of the disease, as it occurs about equally among males and females.

Age has much more influence in its production.

Of the decimal periods the greater number of first attacks occur between ten and twenty, next perhaps between twenty and thirty,

while a considerable number are attacked before ten, but very few after forty-five.

When there is a strong hereditary taint the disease is apt to commence at an early period, and children who have suffered from eclampsia are more liable to become epileptics than others.

Anæmia, chlorosis, scrofula, rickets, and alcoholism, are classed among the causes. Various peripheral irritations, such as gastro-intestinal diseases, irritations of the sexual system—especially adhesions of the prepuce and other irritations of the glans penis—diseases of the sciatic nerve, cicatrices involving nerves, and a variety of peripheral lesions act as exciting causes. Irritations in the abdomen reflect strongly on the brain. The colon is often in fault. When its secretion is perverted, when it is contracted or distended, when it is loaded, sacculated, and depressed, the brain is apt to suffer, and epilepsy may be induced. Convulsions are often attributed to the presence of intestinal worms, and the irritations they induce may cause attacks.

Violent mental impressions or excitements, as fright, anger, surprise, acting suddenly ; or anxiety, care, misery, and privation, operating more slowly, may act as causes.

When the epileptic disease or constitution exists, any peripheral irritation may be an exciting cause of the convulsive attacks. In the experiments of Dr. Brown-Séquard, guinea-pigs which have been made epileptics by wounding the spinal cord or brain will have fits produced by pulling the hair upon the side of the face, which he calls in them the “epileptic zone.” So irritation of the stomach, the bowels, the urino-genital organs, or the extremities, or any part of the skin, as from eruptions, cicatrices, etc., may excite a fit.

Prepuccial irritation is regarded by some as the exciting cause not only of attacks, but of the whole diseased state.

Hystero-epilepsy is particularly influenced by conditions of the genital organs, and probably more by those of the ovaries than of the uterus.

Diagnosis.—It is not difficult to distinguish an ordinary or typical epileptic fit from other affections which may resemble it, when the phenomena which have been described are borne in mind. But some forms of epileptic seizures, the “*petit-mal*” and other irregular and imperfect varieties, resemble some other affections. They may appear like *syncopal attacks* or like vertigo. In epilepsy there is sudden loss of consciousness, generally absolute, and without the sense of faintness ; the recovery is rapid, and often there is no remembrance that anything unusual has occurred. In vertigo consciousness is not lost, in fainting it is, when complete, but there is more recollection of the preceding and subsequent events, there are

fewer convulsive movements, and there is some apparent cause for the syncope. It should also be distinguished from simple cerebral congestion, from cerebral hemorrhage, from hysteria, from infantile convulsions, from uræmia, from eclampsia produced by excessive peripheral irritation, and from convulsions produced by such organic diseases of the brain or membranes as inflammation, tumors, etc.

Convulsions, such as arise from teething, intestinal irritations, worms, and the like, differ from the organized convulsive affection constituting epilepsy, not so much in the apparent character of the paroxysm as in the history of the case and the accompanying conditions. Convulsions, however, that are simple and peripheral at the beginning, sometimes become central and habitual in their continuance, and merge into epilepsy.

Simple convulsions are most frequent in infancy, and disappear on the removal of the exciting cause; but when they continue to occur after the first teething is over, and without distinct exciting causes, there is reason to fear they are merging into epilepsy. The invasion of simple convulsions is less sudden, with less speedy loss of consciousness; there are spasmodic startings, grasping the thumb in the palm of the hand, grinding the teeth, feverish excitement, and other similar manifestations preceding the first attack.

Eclampsia from poisons in the blood, as in uræmia, scarlatina, and other fevers, will have the other symptoms of these conditions to aid in the diagnosis; and the same may be said in cases of convulsions from tumors and other obvious organic diseases of the brain, and from well-recognized dyscrasias, or from temporary shocks to the system.

Epilepsy is a distinct, organized, constitutional affection, with a history of recurrence, though there is of course a first attack; but that is commonly without any markedly apparent exciting cause, and the recognition of this will aid in distinguishing it from all other affections.

The *diagnosis* of the *petit-mal* at its beginning is of great importance, as, if not efficiently treated, it is almost sure to end in all the serious consequences of epilepsy. It is to be particularly distinguished from vertigo arising from derangement of the stomach, oxaluria, etc. In vertigo proper there is a sensation of "whirling about," as if the patient or his surroundings were moving in circles. In epileptiform attacks there is a sense of confusion, but not of whirling around. There is a sensation often of something rising toward the head from the stomach or some other part.

All the sensations in "minor epilepsy" are usually sudden, may be flash-like, while in vertigo and cerebral syncope the symptoms increase and continue for a longer time.

In fainting the patient is limp, and also in some cases of hysteria, while in others there are spasms often lasting many minutes. In minor epilepsy there is momentary rigidity with staring, open eyes and dilated pupils, and consciousness is momentarily lost, though the patient may not realize it. In syncope and hysteria the eyes are usually closed, in hysteria often tightly. The most characteristic symptoms of the epileptoid condition are the dilated and fixed pupils and the loss of consciousness. In other epileptoid cases sudden fits of melancholy or mania occur, and, later on, attacks with more physical and convulsive phenomena.

Epilepsy has been feigned, but it would require much practice and a peculiar talent on the part of the malingerer to deceive one familiar with the phenomena of the real disease. Something is likely to be left out or overdone by one who could have a motive for simulating the affection.

Prognosis.—When epilepsy is fully established, has existed for a considerable time, and the paroxysms have become habitual, the prognosis must be regarded as unfavorable as to a perfect and permanent cure. When recent, and especially if still eccentric, under proper management a cure may be expected, or at least hoped for.

A hereditary taint, serious injuries of the brain, marked mental failure, the grand fit occurring at long periods, with many small and imperfect paroxysms in the interval, and an absence of removable peripheral irritation are conditions unfavorable to recovery.

A matter of deep interest to the patient and friends is the effect to be expected from the continuance of the disease upon the *mental state*. According to Reynolds, hereditary taint is without influence upon the probable conditions of the mind; the female sex is more unfavorable; so is a late commencement of the disease; while an impaired state of the general health is rather of favorable import as to the mental state; the mere number of attacks has but little influence; but a very rapid recurrence of seizures is more unfavorable; and the minor attacks, which are so often frequently repeated, are more unfavorable to mental integrity than the occasional severer paroxysms. We should be careful in our prognosis and skeptical as to a cure having been effected, since long intervals may occur between paroxysms, and relapses, after years, may take place.

The momentary flash-like minor attacks are often very obstinate, even more so than the *grand-mal*, in which they are likely to terminate, or with which they alternate. The frequent and long-continued occurrence of epileptic attacks, of whatever form, seldom fails to produce serious mental impairments of one form or another, and often muscular impairment as well.

The *danger to life* is by no means great—epileptics very seldom die in a paroxysm unless from the accidents of falling—but the severer form of the disease is scarcely compatible with very long life. A sudden and complete arrest of the attacks, whether spontaneous or the result of treatment, is thought by some to be unfavorable, leading to other and more serious manifestations of a general morbid state.

Treatment.—The treatment of epilepsy may be divided into that of the fit, and that in the interval of the paroxysms.

The subject of the treatment of the fit is readily disposed of. In cases where warning is given, dashing cold water upon the face or back of the neck, applying ammonia to the nostrils, inhaling a moderate quantity of carbonic acid gas, sudden peripheric irritations, as pulling upon the toes, etc., as suggested by Dr. Brown-Séquard, or the inhalation of chloroform or ether (these latter articles sometimes mitigating the severity of the paroxysm where they do not prevent it) will sometimes arrest an attack. A hypodermic injection of morphine or atropine, or the two articles combined where a night attack is threatened, or a proper dose of chloral hydrate may at least postpone its occurrence. The nitrite of amyl given by inhalation operates very speedily, bringing the blood to the surface capillaries, and is said often to arrest an impending attack. From three to eight drops in a pearl, which may be crushed in a handkerchief and applied over the nose and mouth, is a convenient and comparatively safe method of using it, and may be cautiously tried. It is worthy of a trial in cases where the fit is protracted—in the status epilepticus—and is also recommended for the frequently recurring slight attacks—the *petit-mal*—and even permanent cures have been reported from its use.

When an aura is felt, commencing in an extremity, the tightening of a strap or firm ligature about the limb before the sensation reaches the body may arrest it and the fit. Dr. Brown-Séquard advises that in such cases a strap be worn around the limb, to be instantly tightened when the aura is felt. Dr. A. McL. Hamilton advises nitroglycerine for preventing the paroxysms when threatened. Dissolved in alcohol it is non-explosive, and one tenth of a drop in proper dilution in alcohol, applied to the tongue, acts very speedily, increasing circulation of blood in the brain. It needs further trial to determine its value in arresting the impending fits.

When the fit is actually in progress, and is not protracted beyond the usual length of time, nothing need be done but to remove restraint of clothing and to put the patient in a position where he will not receive injury. A cork may be inserted between the teeth where the tongue is liable to be severely bitten. Should the convulsion be much protracted, ether or chloroform inhalations may be tried, and

when a hysterical element is present in females, firm pressure continued over the region of the ovaries should receive a fair trial.

The *main treatment* of epilepsy is during the interval of the paroxysms, with a view of modifying the pathological conditions and preventing or mitigating the phenomena of the disease.

As there is a peculiar condition of the nerve-centres constituting the epileptic state, and very often some peripheral irritation provoking attacks, two indications present themselves. The *first* is to remove these irritations, and the *second* to modify the central morbid conditions.

1. The means necessary for fulfilling the first-named indication are various, as these irritations are in different situations and of different characters, and remedies must be selected on rational principles. The great importance of attending to this indication will be understood when it is remembered that peripheral irritations may excite convulsions which may become central; and that when there is a central morbid state, peripheral irritations are often required to induce the fits. In Dr. Brown-Séguard's experiments upon guinea-pigs, made epileptics by artificial lesions of the brain or cord, pulling the hair upon one side of the face and other external irritations would excite the fits, which would otherwise occur very seldom or not at all. These peripheral irritations may be external or internal—external injuries and their results, cicatrices involving nerves, tumors pressing upon them, prepuceal irritations, cutaneous eruptions, spicula of bones, etc. Or the irritations may be internal—within the abdomen, the pelvis, or the thorax. These were referred to when describing the causes of the disease; and their respective characters will suggest the remedies. A deranged and irritated stomach, a loaded or otherwise morbid condition of the bowels, will require alteratives, laxatives, tonics, and other agents according to their conditions. Pelvic disease will require appropriate treatment, and external affections may demand surgical measures. Circumcision will often avail something when the prepuce is adherent, much elongated, or restricted. In short, all the conditions of the patient must be carefully inquired into and every unfavorable state, so far as possible, removed. The blood and the general state should be improved when at fault, and every hygienic regulation should be particularly observed.

The appetite is apt to be variable and at times ravenous; it is often indulged immoderately, and sometimes the food is "bolted." The appetite when excessive should be restrained, the diet regulated, and imperfect mastication and rapid ingestion prevented. The use of alcohol and tobacco, and of strong tea and coffee should be prohibited. Dr. Bartholow says: "Coffee, tea, tobacco in any form, and all kinds

of alcoholic drinks must be forbidden in all classes of epileptics." Excessive venery, especially unnatural sexual excitements, masturbation, irregular habits, exhausting labor, and worrying care must be avoided.

Nothing can be more important than the observance of these directions. However much effect may be produced by medicines, they become comparatively powerless without proper hygienic observances. The simple regulation of the diet, especially when stomach symptoms are present, or when an aura arises from the epigastrium, is often followed by the most marked improvement. In some cases restriction to a milk diet for a time will be beneficial, and Bartholow is of the opinion that "the permanent diet should not exceed milk, eggs, a little meat once a day, a single vegetable, a very little bread and butter, and one fruit." The necessity, or even propriety, of restricting the diet to this extent, as a general practice, may be questioned, but that it is important in some cases I have no doubt. Too much judicious care cannot be taken of the stomach and bowels; but to describe all the means necessary in different cases would take us over the whole ground of derangement of those organs. If worms are present they should be expelled, a sacculated colon should be unloaded, constipation should be overcome, dyspeptic conditions removed, and the general tone of the system kept up. These are rational, in contradistinction from empirical or specific measures.

2. The *second* indication—that of removing or modifying the central morbid state, which is the essential condition of epilepsy—often presents difficulties in its fulfillment that are insuperable. Many organic lesions of the brain, which may operate as causes of epilepsy, it is impossible to overcome. The "epileptic constitution," when existing without recognizable structural lesions, particularly when hereditary, is apt to be an obstinate and persistent condition incapable of permanent removal. The epileptic habit, when firmly established, is not easily interrupted, though its first cause may have been peripheral irritation. Yet some even advanced cases are amenable to curative treatment, and very many are capable of marked alleviation.

On the assumption that a morbid excitability of the medulla oblongata is the most essential condition in epilepsy, there is a particular indication to allay that excitability. So far as this view of the pathology of the disease is established, and so far as it is proven that particular remedies are capable of allaying that excitability, such remedies are rationally indicated for that purpose, and the treatment with these is on rational principles. But the correctness of these pathological and therapeutical doctrines is, perhaps, not demonstrated, and the treatment with the view of removing the epileptic state is

largely empirical. Certain remedies are known from experience, and many on the same grounds are believed, to have mitigated the severity of the disease, and sometimes to have arrested it, and may therefore be prescribed.

Among the numerous remedies alleged to have been useful, the bromides at present stand preëminent. These remedies, first used in epilepsy by Locock and McDonnell, have won their way to a degree of professional confidence in the treatment of epilepsy which no other class of remedies has attained. Many articles in the past have obtained a reputation for the cure of this disease which they have not deserved, and the bromides may now have credit beyond their merits. It is difficult to determine the exact value of remedies in a disease so uncertain in its course as epilepsy. In many cases the occurrence of the paroxysms is suspended for long periods spontaneously, and in others an impression with a variety of agents of very opposite characters seems to have the effect to prevent for a considerable period their occurrence. In time the patient, after such suspension, is lost sight of by the physician, and a cure by a particular remedy may be reported while the disease is going on. But making due allowance for these sources of error, there can be no doubt that the bromides have much power in controlling the frequency of the attacks, and in some cases in overcoming the disease. They unquestionably diminish reflex excitability, especially of the medulla oblongata, when their full effect is produced. The external parts supplied by nerves from this region have much less excitability under the influence of these agents. The uvula, soft palate, and even the epiglottis may be touched with a spatula without exciting nausea or other reflex actions, and the medulla responds much less readily to any form of irritating influences, and convulsions are less likely to occur.

In many cases they are palliative rather than curative; but sometimes they effect a permanent change in the susceptible centre and a cure is produced. More decided effects are apparent where the paroxysms are frequent and severe, but in all forms of the disease the tendency is to mitigation. Of the different bromide salts, that of potassium was first and is now most used, and is most efficient. Dr. Ranskill of the London Hospital thinks the comparative efficiency of the three leading bromide salts in epilepsy is in the proportion of *three* of bromide of potassium, *two* of bromide of sodium, and *one* of bromide of ammonium. The bromide of sodium is less likely to irritate the stomach, and may be substituted for the bromide of potassium when the latter is not well borne by that organ. The bromide of lithium has also been recommended.

The manner of using bromide of potassium, and its ultimate

effects on the organism are matters of much importance. It is readily diffused in the system, and is largely retained until a degree of saturation occurs, when it is eliminated chiefly by the kidneys. The addition of free bromic acid does not increase its effects upon epilepsy, and hydrobromic acid is thought to be much less efficient than the salt. There are differences as to the susceptibility to its therapeutical effects, and as to the endurance of what some call its "drug action." Some patients respond readily to its therapeutical action in moderate though not in small doses, while others require much larger quantities to produce an effect. Occasionally the stomach is found to rebel against it, and some will lose strength and become anæmic under its use; while others will tolerate it in free quantities and retain vigor and freshness under its free and long-continued use.

The ordinary dose of the bromide of potassium for an adult is one scruple three times a day, or one drachm in twenty-four hours. Some will bear and require more than twice that quantity to produce any decided effect, while others cannot bear as much, at least for any length of time. It is more active when given upon a comparatively empty stomach, and it is often better to give a larger dose at bedtime than during other hours of the day. I generally order it given between meals and at bedtime, well diluted in water.

The quantity to be given must be governed by its effects. I usually commence with about sixty grains a day, and if none of its physiological effects are observed, such as a coated tongue, foul breath, slowness of speech, staggering gait, cutaneous eruptions, etc.—evidences of bromism—in the course of about a week I gradually increase the dose until such effects are moderately produced. I then discontinue the medicine until these effects disappear, aiding their subsidence, if they are decided, by a saline cathartic. I then commence the bromide in smaller doses, and give as much as will be borne *without unpleasant effects*, continuing the treatment indefinitely for months, and sometimes for years. Patients under my observation have taken the bromide in quantities of from forty-five to sixty grains per day, with only short occasional intermissions, for three and four years, enjoying all the while excellent general health, but feeling "warnings" of epileptic attacks whenever for a few days, or sometimes for a single day, the medicine was discontinued. Dr. Hammond is reported to have said in a discussion on this subject in a medical meeting, that if he were an epileptic he should expect to take bromide the rest of his life. All, however, cannot bear it in long-continued doses. Debility of body and mind, spanæmia, and other injurious effects are sometimes realized from the ordinary doses, and the larger doses, long continued, very often are followed by serious

consequences. When evidences of injurious effects appear, the doses must be diminished, their debilitating effects counteracted by tonics—quinine, iron, strychnine, etc.—or the administration must be discontinued entirely.

As already stated, the quantities proper to be given will vary in different cases, and the proper limits are variously stated by different authors. Thus Ringer advises from 30 to 60 grains a day, Reynolds from 30 to 90, Howard from 90 to 240 in severe cases, and Bartholow from 30 to 240. Rosenthal begins with 60 grains daily, increasing the dose in ordinary cases to from 90 to 130 grains daily, and, in some forms of the disease, commencing with 130 grains a day he increases it to 180, very seldom to much more. Others advise smaller quantities than any that have been mentioned, but much greater efficiency attends the use of large doses, and when the effects are carefully watched and unpleasant consequences properly guarded against, evil results may be avoided.

While bromide treatment is being pursued, the indication for correcting whatever is wrong in the general system or in any parts of the body will continue, and must be met by appropriate treatment. In some cases where pain in the head has been severe and persistent, I have found a seton in the back of the neck to be followed by marked relief.

Among the remedies which have been used empirically for epilepsy are belladonna, ergot, stramonium, cicuta, digitalis, arsenic, strychnine, nitrite of amyl, codliver oil, nitrate of silver, preparations of zinc, copper, and bismuth, the antispasmodics, and lately nitro-glycerine.

Belladonna, or its active principle atropine, fulfills nearly the same indication as the bromides, and in cases where the latter are not well borne belladonna may be used in their stead. An appropriate dose of the fluid extract or the tincture may be given by the mouth, or a solution of atropine may be used in the same way or hypodermically, and the measure of the effect to be produced is a moderate dilatation of the pupils and slight dryness of the throat. When the remedy is long continued, a quantity just below that will act as a general alterative.

Arsenic as an alterative and tonic, especially if there be certain gastric disturbances or chronic cutaneous diseases, has a deserved reputation. Fowler's solution, in doses of from five to ten drops three times a day, has very strong advocates. Digitalis may be required in certain heart complications, and chloral hydrate, when there is unusual restlessness and want of sleep not controlled by the bromide. It must be borne in mind that a habit of narcotism may be induced

by the chloral, and its long continuance cannot, as a rule, be advised. In large doses it is not without danger ; but some advise its combination in moderate doses with bromide of potassium, and the combined action may be an improvement in exceptional cases.

Nitrate of silver some years ago stood high in the list of reputed remedies for epilepsy, but at present it occupies a much lower place, and is seldom prescribed. There are, however, cases where its effect upon the mucous surface of the stomach may be very beneficial, and also where it may be useful as a general tonic.

Quinine in full doses, preceding attacks which observe a periodical recurrence, will be likely to be useful ; and preparations of iron in anæmia should not be neglected. The use of the nitrite of amyl in epilepsy has already been referred to ; and the nitro-glycerine has not been sufficiently tested, even in aborting a fit, to determine its value. It is said to act very speedily in doses of one tenth of a drop, or even less, producing flushing of the face, brightness of the eyes, throbbing of the temporal vessels, and a more lasting congestion than nitrite of amyl. By these effects it may abort an approaching attack, but as to its producing any permanent effect in the disease, we have no sufficient evidence. While alcohol prevents its explosion, we can, when it is diluted in that menstruum, give any fraction of a drop. The dose for continued administration is a still smaller fraction of a grain. Since commencing the writing of this paragraph I have allowed to dissolve upon my tongue a granule said to contain $\frac{1}{16}$ part of a grain of nitro-glycerine, with the effect of producing a very sensible feeling of fullness in the forepart of the head, amounting to a slight pain, and an increased pulsation of the temporal arteries. These effects have lasted some fifteen minutes, and are now subsiding. The physiological effects of this article, it seems, are quite marked, but future experience must determine its therapeutical value.

Various compounds have been advised by different authors. The addition of a few grains of carbonate of ammonia is thought to render a dose of bromide of potassium more active. When nutrition changes in nerve-centres, such as sclerosis, or the organized results of a slow inflammation are suspected, *iodide of potassium* may be added to the bromide with advantage. If a syphilitic condition has existed, however remote, the iodide is particularly indicated, and a course of the bichloride of mercury may be required.

Dr. Brown-Séquard's ordinary prescription is well known. It is iodide of potassium, ʒj ; bromide of potassium, ʒj ; bromide of ammonium, ʒijss ; bicarbonate of potash, ʒij ; infusion of columbo, fʒvj. —Mix. A tea-spoonful to be taken before each meal, and three tea-spoonfuls at bedtime, each dose in some water.

Dr. Hammond often conjoins with the bromide, oxide of zinc in two-grain doses, three times a day, for a few weeks, and, after this, strychnia in doses of from one thirty-second to one twenty-fourth of a grain.

Dr. A. McL. Hamilton advises the following compound :

℞ Sulph. of Strychnine, gr. j ; Fl. Ext. of Ergot, ℥jss ; Fowler's Solution, ℥ij ; Bromide of Sodium, ℥jss ; Tinct. Digitalis, ℥iij ; Mint Water to ℥jv.—M. Dose, a tea-spoonful before meals in half a glass of water.

Dr. Seguin advises in idiopathic epilepsy the following : ℞ Bromide of Potassium or of Sodium, ℥j ; Bromide of Ammonia, ℥ss ; Water, ℥vij. Dose, a tea-spoonful.

M. Ball, of the Paris School of Medicine, advises the combination of drugs in the treatment of epilepsy. He often prescribes the bromides simultaneously with the oxide of zinc and belladonna, the bromides in solution, with gradually increased doses until effects are produced, while the belladonna and zinc are given according to the following formula : ℞ Extract of Belladonna, grs. xv ; Oxide of Zinc, grs. xv—for forty pills, two pills a day, one morning and evening, and at length four a day, two at each morning and evening dose.

It is generally agreed that the dose of the bromides given at bedtime should be larger than either of those during the day. Preparations of opium are not without temporary benefit in some cases of epilepsy, but great care must be taken not to establish the opium habit.

Recently, Dr. Henry M. Hurd, Superintendent of the Eastern Michigan Asylum for the Insane, has recommended *cocculus indicus* in cases of confirmed epilepsy complicating insanity. He has used a fluid extract manufactured by F. Stearns, of Detroit, of which the commencing dose is one fourth of a drop, which is carefully increased week by week until three fourths of a drop is given three times a day. Dr. Hurd avers that "the remedy undoubtedly possesses marked restraining power over the disease, and its effect has almost invariably been to reduce the number and severity of the convulsive seizures. Unlike the bromides of sodium, potassium, or ammonium, its persistent use does not impair the intellectual faculties, but rather stimulates and increases mental action." Cases are reported where its effect seemed to be marked ; and if efficient in epilepsy with insanity—one of the most formidable forms of the disease—it may be presumed to be useful in other cases ; but its value, and the class of cases to which it is adapted, must be determined by future experience. It is reported to appear "most beneficial to persons in good bodily health, whose convulsive seizures are accompanied by attacks of maniacal excitement."

Gentle currents of electricity are advised by some, and in certain cases may act beneficially. Chapman's ice bags, applied occasionally to the spine, have been regarded favorably by some, but they have not been used on a sufficiently large scale to establish their merits. The simple antispasmodics, such as asafœtida, valerian, etc., seem to have but little effect.

Various surgical operations, other than those alluded to, have been performed for the cure of epilepsy. Ligation of a carotid, and tracheotomy were advised, and after injuries of the head trephining; and some years ago castration was sometimes performed.

The results of none of these operations have been such as to afford much encouragement for their repetition, though in some cases where portions of the skull have been depressed, or where spicula of bone have irritated the membranes or the brain, relief has followed the use of the trephine. Most of such cases, however, that have come within my own observation, have resulted unfavorably.

The medico-legal relations of epilepsy have an interest. Sudden temporary impulses to violent acts sufficient to destroy responsibility sometimes occur, constituting a form of fitful, temporary insanity; and not very unfrequently more permanent forms of insanity complicate cases of epilepsy. The fact of the existence of epilepsy by no means destroys responsibility, but should be considered and have much weight where motiveless and especially sudden acts of violence are committed.

DISEASES OF THE MIND.

The subject of mental affections is a department of general medicine and belongs to internal diseases, and therefore comes within the scope of this work.

These diseases have, however, peculiar characters and relations, which to some extent separate them from other affections. They require peculiar modes of management, usually best carried out in asylums equipped with various appliances for the purpose. These are in the charge of specialists, who are withdrawn from the labors of a general medical practice, and who confine their attention to this class of diseases. For these reasons mental diseases become a specialty, and the whole subject is treated of at length in separate works. Notwithstanding this, the general practitioners of medicine cannot escape the care and responsibility of mental diseases. They are liable to occur in every locality; they first come under the care of the family physician; he must determine their character, and what is to be done for them; must commence the treatment when treatment is of most

importance, and continue it until the patient is otherwise provided for; and if he is sent to an asylum, it is upon the physician's certificate of the nature of the disease and the propriety of such a procedure. Questions of competency to manage affairs, of the disposal of property, of guardianship, of deprivation of personal liberty, and of responsibility for injurious or criminal acts are arising, which the physician is called upon to meet.

As special treatises on mental diseases are not found in the library of every physician, it is thought advisable to present in this work, intended especially for students and general practitioners, a condensed account of these affections. This account is not intended to take the place of the more extended works which may be required by specialists, but to present such views upon the subject as should be familiar to every one who assumes to become the medical adviser of families or individuals.

Before proceeding to the discussion of particular diseases of the mind, some observations will be made upon the mind itself, with the view of aiding proper conceptions of its normal, and therefore of its morbid, conditions; for diseases of the mind, like all other diseases, are but deviations from the normal state.

In the study of the mind and its diseases, as in the study of the principle of life and of various other physiological and pathological subjects, obscurities will be encountered. Some things will be merely conjectured, others will be matters of rational belief, while many things will be matters of knowledge—of facts as clearly observed and as positively known as any facts in nature. Hypotheses in any science may be employed as aids in investigation; but they are not facts, and should be held loosely; and mere beliefs, however rational, are not the foundations of science.

Science deals with observed and demonstrated facts; and, in treating of the mind and its diseases scientifically, conjectures and beliefs must be set aside. We can proceed only upon the facts which are open before us; but by confining the attention to such facts we by no means disparage beliefs in other truths beyond the sphere of our immediate observation and knowledge. The denial of the correctness of such beliefs would be presumption, and as unscientific as the erection of a system upon conjecture.

We arrive at the facts of the mind, subjectively and objectively, by its conscious workings within ourselves, and by observing its manifestations in others, and not by processes of speculative reasoning.

By mind we understand that part of sentient beings which perceives sensations, experiences perceptions, which forms, receives, entertains, and recalls or remembers ideas. It is that which reasons,

believes, hopes, and fears. It is that which apprehends the beautiful and the repelling, the good and the evil, the true and the false, and which in higher natures grasps after the Infinite and the Eternal. It is that which wills—which consciously and freely determines, and puts forth acts. It is that which loves and hates, which enjoys and endures the thousand internal feelings or emotions that belong to human beings.

Although the mind is regarded as in an important sense a unit, it is spoken of as consisting of a variety of parts or faculties, and these have been differently divided and classified by different writers. The metaphysicians, the empirical psychologists, and the physiologists have their peculiar methods of treating the subject, and almost every individual writer has his own particular classification.

The tendency of modern psychology, however, is to arrange all the different facts of mentality under three general divisions, viz.:

1st. The Sensibilities or feelings—including the impressions connected with the external senses, as well as the internal feelings—the emotions and sentiments.

2d. The Intelligence, or the knowing and reasoning powers—the thinking faculty.

3d. The Will—the volitional or determining and acting power—the force which directs attention and controls actions not only of the body but of the mind.

There are a variety of feelings, all of which are both bodily and mental, for bodily feelings are perceived in the mind, and mental feelings impress and are manifested through the body. As the feelings are the first of the faculties to be affected by disease, they should receive a careful recognition.

Consciousness is a feeling, and when healthy gives us valuable information of what is passing within us and of the facts of the external world, but when morbid leads to false conclusions. Whatever be the case with other faculties, the feelings are connected with consciousness. Ingoing impressions which call forth responses, as in reflex action, may occur without consciousness. These have analogies to conscious feelings, but are different from them. Feelings proper are conscious conditions.

Many feelings are the result of external impressions, but some are dependent upon the flow of ideas through the mind, or are connected with the production of ideas. We have a general feeling of bodily existence, it may be of comfort or discomfort—of health or disease. We have the feelings of all the appetites—desires for their gratification, of satiety when they are satisfied, and of loathing from excess.

There are general feelings of exhilaration or depression, and of

pleasure or pain connected with the outer senses. There are also feelings of the inner sense—of “lightness of heart,” or, on the contrary, of “low spirits”—“heaviness of heart”—feelings of content or discontent, and all the sensibilities connected with good or bad temper. There are feelings connected with ideas: with disgust or approval, suggested by the senses, and of hope and fear, pride and shame, self-approval and remorse, prompted by the understanding and the conscience; and there are feelings connected with the observation of physical beauty and ugliness, prompted by the taste.

There are also more purely intellectual feelings—pleasure in acquiring knowledge, in observing novelty, system, order, symmetry, and harmony; pleasure derived from wit and humor, from the comic and the ridiculous; and, higher than these, there are feelings of satisfaction from the contemplation of truth, and from the higher beauties of poetry, of eloquence, and of art. And still higher are the moral feelings, arising from a love of right and a dislike of wrong, and from sympathy with others in their joys and sorrows; and last and highest are the religious feelings, produced by the exercise of the religious nature.

In fact, all the conscious functions of the body and the mind have feelings connected with their exercise. The passions, so called because they so frequently produce suffering, are only intensified feelings; and all the propensities and impulses, whether under the control of and in harmony with reason and conscience, and therefore good, or not under such control or sanction, and therefore bad, may all be placed under the head of feeling.

The *second* class of the facts of mentality—the Intelligence—embraces perception, apprehension, ideas, memory, understanding, imagination, belief, doubt, knowledge, logical processes, judgment—either of truth or right—and the pure reason. Conscience consists of a judgment of right and wrong, together with an impulse to do the right, with a satisfaction when it is done, and a repugnance to do the wrong, and pain when it is committed. It is therefore a faculty consisting of moral judgment and moral feeling.

In the *third* division of the facts of mentality—the Will—is embraced all the voluntary activity of the man, all the immediate causes of those activities which are determined and directed by the mind. There has been much theoretical disputation as to the nature and power of the will—as to its freedom—both among metaphysicians or psychologists and physiologists; but upon its freedom practically depends all moral responsibility certainly, and upon its healthy normal condition—its essential liberty—must depend all social and legal responsibility also.

Consciousness, or the evidence to ourselves of our existence and of what is going on within us—of subjective realities—is not a separate faculty so much as a light to other faculties. We are compelled to take its testimony as truth, and in its normal and healthy exercises it is reliable; but in disease it is a source of delusion and error. A morbid consciousness produces false conclusions. Whatever other faculties are concerned in mental perversions, a morbid state of the consciousness is present. A delusion is an erroneous conscious state.

A distinction is made between Illusions, Hallucinations, and Delusions. The term illusion is usually applied to a changed action of an external sense. An illusion of sight or sound is where an object is seen, or a noise is heard, but different from its real character. When a white cow is seen as a shrouded ghost, or a post as an armed sentinel, when the barking of a dog is heard as the calling of a man, there is an illusion of the senses.

An hallucination is an unreal perception, where there is an appearance of an object when no object is present, as when in the dark or with the eyes closed a form is seen, an image is impressed upon the centre of perception without the light from a real object; or when a sense of sound is impressed upon the auditory centre in the absence of the vibrations causing real sounds.

When the intelligence or the reason is in full action, both illusions and hallucinations may be understood as such, and their real character apprehended by the mind. When, however, the intelligence or the reason is perverted, and the false impressions are believed in as realities, *delusions* exist. Illusions are external in their origin, hallucinations are central; delusions may be connected with the external senses, with the internal perceptions, or with any actions of the mind. They are false and usually absurd beliefs; and such unrealities, perceived in the perverted consciousness as realities, and acted upon as such, constitute the most essential element and condition of insanity.

In the most complete forms of insanity all the various faculties of mind are perverted, and in most cases, though some faculties are affected more than others, or the perversion is greater in relation to particular subjects, the whole mental constitution is thrown from its balance, and the individual is more or less alienated from his proper self.

Notwithstanding our recognition of various faculties of the mind, as of different organs and functions of the body, yet they harmonize into a *single mind*; and indeed the mind and body constitute a unity—a single entity—and in a scientific point of view we can no more separate mind and body from their intimate relations than we can separate function and organ. The mind, as we apprehend it scientific-

cally, has been declared "the sum of all cerebral states." The body and mind are mutual in their activities. They do not so much act upon as with each other, and they together constitute a unity to be studied as a whole. How matter can manifest the phenomena of mind we are entirely unable to comprehend. We cannot "even settle the question of the existence or the nature of the media between them." We cannot, indeed, understand how matter can produce other phenomena of life, but we must accept observed facts, and we can study these facts as matters of science.

There are two methods of studying the phenomena of mind. One is by looking outside of our individual selves to its manifestations in others. This is called the *objective* method. The other is by examining ourselves; observing by introspection the operations of our own minds. This is called the *subjective* mode. This latter almost exclusively prevailed during the long period of metaphysical or speculative philosophy. But very little advancement was made, even from the time of Plato, until, in very modern times, the objective method was combined with the subjective. The study of mind objectively in healthy adult men, in children, in idiots, in lunatics, and in animals in different degrees of development, has thrown a flood of light upon the subject, and elevated it, in many respects, to the conditions of a science.

In studying mind, as in studying life, we must confine ourselves to facts open and demonstrable. We can only deal with it as we find it, in connection with the body, and we should study it in relation with other things, as a part of that *nature* of which it is the last and highest development.

These observations upon the physiology of the mind, though out of the usual course in a brief account of mental diseases, are regarded as important to a clearer understanding of what is to follow, and may at least be useful to those who have not been engaged in special psychological studies. The recognition of the different mental functions will lead to a better knowledge of the different forms of mental derangements.

As will be inferred from what has preceded, we cannot proceed a single step in a scientific consideration of *Diseases of the Mind* without a recognition of the unquestionable fact of observation, that *mental phenomena are dependent upon physical conditions*—that the mind is only expressed to us through its material organ—the nervous system—and chiefly through the brain; and it is only expressed normally when that portion of the nervous system concerned is in a condition of integrity which renders it capable of performing proper function.

“Whatever opinion we may entertain concerning the intellectual functions, whether they be regarded as manifestations of an independent soul by the intermediation of the nervous system, or as the function of the nervous system, we are always reduced to the necessity of considering the brain as the organ from which the intellectual functions proceed. Every disturbance in the cerebral structure [concerned in mentality], by whatever agency, is immediately reflected in the intellectual functions.” (Vogt.)

Griesinger, Sankey, Maudsley, and all other modern authors of authority hold the same view. The mind, considered as an immaterial principle, cannot be subject to such diseases as are recognized within the sphere of science.

The fact that mind does not manifest itself without its material organ—the brain—is too obvious to common experience to require argument or the statement of authority. We see that, like other parts of the body, the brain, as concerned in the manifestation of mind, is exhausted by long-continued exertion, and refreshed by rest; that it is strengthened by exercise, and weakened by neglect. If defective in organization or development, its power is impaired. If the cerebral hemispheres are absent, mind is not manifested. The poison of prussic acid, of opium, or alcohol, suspends or deranges the functions of mind.

As Dr. Holmes quaintly says: “Inhale a few whiffs of ether, and we cross over into the unknown world of death, with a return ticket; or we prefer chloroform, and, perhaps, get no return ticket.”

A physical concussion, or an intense emotion, may interfere with the proper conditions of the brain and produce abnormal mental actions. It is entirely certain that anything which, for ever so short a time, materially interferes with the circulation of blood through the brain, so as to suspend its nutrition and interrupt its molecular actions, suspends mentality. It is by no means asserted that in thought brain cells are necessarily oxidized, and that thought is the resultant of such oxidation; but in every activity, bodily or mental, there is more or less wear and tear, requiring repairs; and a constant supply of nutrient material is essential to that condition of the brain cells which enables them to perform their functions of mentality.

We can but perceive that the mind is dependent on the brain, and the connection is so intimate that, could we look into the interior of this organ with sufficient clearness, we should probably perceive molecular change, certainly molecular activity, and possibly some degree of chemical transformation, with every feeling, every thought, and every volition.

Changes of a more permanent character are also produced by men-

tal action. In each act residua are left behind. The act is remembered by the brain. The organ becomes inclined to perform it again, and can do it with more facility. Habit is thus established. A brain developed while performing certain actions, healthy or morbid, or accustomed to such actions, becomes permanently impressed or modified—so permanently that its qualities are likely to be transmitted to offspring, like the features of the face or the manner of walking. The transmission of mental qualities, of whatever character, is effected through the organism of the brain, doubtless by peculiarities of structure. Instincts may be said to be transmitted habits, and habits are memories impressed upon the organism. Inheritances of good and evil are thus transmitted, mental and moral, as well as purely physical, confirming the truth of the declaration that “the sins of the fathers are visited upon the children unto the third and fourth generation.”

The importance of keeping in mind the fundamental facts and principles which have been the subject of the preceding statement will be appreciated.

There are various morbid states of the mind occurring as the result of particular agencies, or in the course of other diseases, which have already received attention. *Delirium* is a frequent condition in fevers and inflammations, and in various morbid states of the brain, as we have seen. It is usually a temporary state, dependent upon well-recognized agencies, and, when occurring, is commonly produced by some medicinal or poisonous substances, or is symptomatic of some other disease. The mental conditions in some forms of hysteria, of epilepsy, of trance, of hypnotism, somnambulism, etc., are abnormal, but have been already noticed. *Delirium ebriosum* and *delirium tremens* have been described, the latter apparently occupying a middle ground between simple delirium and insanity. All these conditions will here be passed over.

We are thus brought to the chief subject of this article, a particular form of mental disease,

INSANITY.

The term insanity etymologically means unsoundness. As applied to the mind it means mental unsoundness, mental disease. Technically, however, it means a *particular form* of mental unsoundness.

In the delirium of fever, the intoxication of narcotics, and other morbid mental states, the mind is in an unsound state; but to none of these does the term insanity, in its technical sense, apply. It signifies a more permanent state—a derangement organized into peculiar

forms. As an illustration : Convulsions excited by some transient accidental cause, such as indigestion, worms, or the puerperal state, would be called eclampsia ; but when convulsive actions become arranged into certain definite forms other terms are applied—epilepsy or chorea. These do not usually disappear with the removal of particular transient causes. Insanity is a systematically arranged form of mental disease, and does not cease with the subsidence of a fever or the passing off of the effects of a narcotic.

There are numerous definitions of insanity, most of them very imperfect, and even a concise description of the disease is difficult, the phenomena vary so much in different cases.

A few selections of definitions from some of the most distinguished writers on the subject will illustrate the difficulty of accurately defining the disease, and at the same time will give some notions of the conceptions of authors respecting the character of the affection.

Dr. Andrew Combe says : “Insanity is a prolonged departure from the accustomed mode of thinking and acting of the individual, without any adequate cause.” Nothing is here said of perverted feeling, or of its being a disease, and no event occurs without a cause. The writer doubtless meant that there was no proper external cause for the changed thoughts and acts.

Dr. Tuke says : “Insanity is a condition in which the intellectual faculties, or the moral sentiments, or the animal propensities, one or all, have their free action destroyed by disease, whether congenital or acquired.”

Nothing is said of the will, and this definition would cover delirium.

Br. Bucknill says : “Insanity is a condition of the mind in which a false action of conception or judgment, a defective power of the will, or an uncontrollable violence of emotions and instincts have, separately or conjointly, been produced by disease.”

This definition does not indicate the seat of the disease, and would embrace delirium.

Dr. Casper, of Berlin, says : “Insanity is a disturbance of self-consciousness based on delusions.”

Insanity, however, is more than a simple disturbance of self-consciousness. Other intellectual operations are changed, and there are other perversions than delusions.

None of the foregoing are improvements upon the older definition of Esquirol, which is : “Insanity is a cerebral affection, generally chronic, unattended with fever, and characterized by disorders of sensibility, intellect, and will.”

Maudsley, in his work on the physiology and pathology of the

mind, does not attempt a specific definition of insanity, but in his article in Reynold's System of Medicine, says: "Insanity consists in a morbid derangement, generally chronic, of the supreme cerebral centres, giving rise to perverted feeling, defective or erroneous ideation, and discordant conduct, jointly or separately, and more or less incapacitating the individual for his due social relations." When to this is added the statement of M. Marcé, "That in madness the patient is unconscious of his state," we have perhaps as good a definition as has been given.

The following definition, however imperfect, seems to me correct as far as it goes, and is given as suggesting another view of the disease.

Insanity is a disease of the brain, producing effects of a peculiar morbid kind upon one or more of the mental faculties—on the emotional, intellectual, or determinational functions—those temporary morbid conditions arising from fevers, acute inflammations, the action of narcotics and other poisons, not usually being included in the designation.

Descriptions of the phenomena can alone give an adequate idea of the disease, and satisfactory descriptions are difficult, as the phenomena are very numerous and vary exceedingly in different cases. They can be more satisfactorily given under the different heads into which the general disease is divided; but a systematic classification is not easy, and those cases belonging to the same class are varied by the influences of other diseases, by age and sex, by temperament, by personal peculiarities, by education, by habits, by social position, and by nationality, civilization, and climate.

Besides, the same particular form of mental disease may be produced by different causes, and may even run quite different courses; and the same individual case may present widely different phenomena even within short periods. All this renders classification more difficult.

CLASSIFICATION OF INSANITY.

As with other objects of science presenting many varieties, some arrangement into divisions facilitates descriptions and is essential to a more ready understanding of the subject. So with insanity; and all writers upon it originate or adopt some classification.

There are two leading systems of classifying and naming the different varieties of this disease. One, which is the older and is more generally followed, is based upon the symptoms presented; the other, more modern, is based upon the causes, the natural history, and the pathological conditions present.

The difficulties and diversities of classifications will be best illustrated by giving a sketch of some of them from different authors, and by doing so fuller ideas will be presented of the nature of the disease.

The old medical writers divided insanity into mania—perversion with excitement—and melancholia—perversion with depression.

Pinel divided the diseases of the mind into mania, melancholia, dementia—loss of mental power—and idiocy. Esquirol added to these monomania—perversion of one or a few faculties, or perversion upon a limited number of subjects. Dr. Prichard, of England, made the distinction of moral and intellectual insanity. By moral insanity was understood perversion of feelings, emotions, and propensities, while the intelligence is intact. Dr. Bucknill made intellectual, emotional, and volitional insanity—regarding the will as capable of a somewhat distinct perversion; and Dr. Tuke recognized the intellect, the moral sentiments, and the propensities as capable of derangement, and made idiocy, dementia, delusional insanity, emotional insanity, and mania.

The International Congress of Alienists, which met in Paris in 1867, adopted the following classification:

1. Simple insanity—where no other disease is present—including mania, melancholia, monomania, and other varieties based upon symptoms.

2. Epileptic insanity.

3. Paralytic insanity.

4. Senile dementia.

5. Organic dementia.

6. Idiocy.

7. Cretinism.

Dr. Batty Tuke made these divisions: 1. Arrested or impaired development of the brain—idiocy. 2. Idiopathic insanity—primary insanity. 3. Sympathetic insanity—secondary, following epilepsy, sexual derangement, puerperal and hysterical conditions. 4. Anæmic insanity. 5. Diathetic insanity—where there is some general disease, as tuberculosis or syphilis. 6. Toxic insanity, as from alcohol, opium, chloral, etc. 7. Metastatic insanity—from rheumatism, gout, or healing of issues.

Dr. Schüle has, 1st, states of mental defects or degeneration; 2d, insanity in persons of full mental and physical development. Under the first head are microcephalism, idiocy, arrested development, degeneracy from hereditary influences—moral defects, epileptic, hysterical, hypochondriacal, and periodic mental derangements.

Under the second head are placed neuroses, affecting primarily the mind alone; organic mental diseases, affecting intellectual and

physical functions ; and distinct lesions of the brain, giving rise to various secondary mental disorders.

The late Dr. Skae, of Edinburgh, made a very elaborate classification, chiefly etiological, but recognizing symptomatic peculiarities as belonging to different etiological varieties. His list is as follows :

Insanity with epilepsy.	Phthisical insanity.
“ of pubescence.	Metastatic “.
“ of masturbation.	Traumatic “
Satyriasis.	Rheumatic “
Nymphomania.	Podagrous “
Hysterical insanity.	Syphilitic “
Amenorrhœal “	Delirium tremens.
Post-connubial “	Dipsomania.
Puerperal “	Insanity of alcoholism.
Insanity of lactation.	Malarious insanity.
“ of pregnancy.	Pelagrous “
Climacteric insanity.	Post-febrile “
Senile “	Insanity of oxaluria or phosphaturia.
Anæmic insanity.	Insanity from brain disease.
Choreic “	Hereditary insanity of adolescence.
General paralysis with insanity.	Idiopathic insanity { sthenic asthenic.

The following classification is based on the symptomatic phenomena as affecting the different faculties of the mind, and may at least serve to present another view of mental disease.

INSANITY OR MENTAL ALIENATION.

I. MANIA. Alienation of mind with excitement—often excessive ideation—rapidity and activity of thought—excitement of emotions and conduct. Frequently violence.

II. MELANCHOLIA or mental depression—alienation of mind without much excitement. Marked diminution or more or less loss of mental power,—always depression of feeling and generally sluggishness of thought and action.

[The term dementia might here have been used, but in a broader sense than is common. It might have been made to embrace the condition of mental depression usually indicated by the term melancholia. Dementia, however, is technically used to indicate simple loss of mental capacity, stupidity and silliness, a want of understanding, without

delusions, painful depression of feelings, or emotions. But it is difficult to use terms with precise and restricted meanings when applied to conditions so variable and mixed. In mania, some faculties are depressed, and in melancholia some are excited, and it is impossible to reduce all cases to a precisely classified variety.]

MANIA is divided into general and special :

1. *General*—Where all, or nearly all, the faculties are excited and deranged.

2. *Special*—Where one or a few are chiefly involved.

Maniacal excitement may affect chiefly—

1. The feelings or any of them. Emotional mania.

2. The intellect, or any special division of it. There may be perceptible only a single delusion, or there may be many. Intellectual mania, excited delusional insanity.

3. Excitement of the determinational or will function—volitional mania—excited willfulness without delusions.

MELANCHOLIA, or mental perversion with depression, is divided like mania into general and special :

1. *General*—Where there is general depression or diminution of mental powers, or of the faculties in general.

2. *Special*—Where there is depression or diminution of some particular faculties.

Melancholic depression may affect—

1. The feelings—depression of the emotions—painful sensibilities—mental distress.

2. Diminution or depression of the intelligence—wrong judgments from feebleness or loss of mental power. The intellect being unable to properly interpret the painful emotions, delusions result.

3. Diminution of volitional power—inability or repugnance to act in the usual way—abandonment of pursuits.

Idiocy and *Imbecility* are different degrees of simple deficient mental power, congenital or occurring previous to adult development. This may be (1) *General*—All the faculties deficient ; or (2) *Special*—Some faculties deficient or absent while others are developed, sometimes extraordinarily.

This account of different classifications gives a general view of more varieties of mental alienation, notwithstanding the repetitions, than can readily be given in the same space in any other way. It must, however, be borne in mind that one form of the disease runs into another, that similar causes produce dissimilar effects, and dissimilar causes produce similar effects, that all classifications are imperfect, and that each case must be individualized for study and management. It can by no means be claimed that the classification of Dr.

Skae on the basis of etiology is without defects, and, as a complete classification, it has met with well-founded objections; but it has the advantage of keeping before the mind the fact that insanity is a bodily disease, it suggests many of its causes, and it is alleged by its advocates that though great varieties of symptoms are found in cases dependent upon the same cause, yet those produced by each particular cause have some features in common entitling them to belong to one of these particular classes.

From what has preceded it will be understood that insanity is a disease of the brain, and has the strongest analogies to other diseases of that organ, and indeed to all diseases. Although it may be produced by impressions upon the mind, those impressions affect the material organ, and the disease, in all cases, has a physical basis. Other diseases may also be produced by impressions upon the mind, but it is because the mind and the body constitute a unity of organism and function.

The manner in which a morbid state of the brain produces the phenomena of insanity may not be understood, but the manner in which a healthy brain produces the phenomena of a sane mind is equally incomprehensible. We certainly do not know how it is that an excitement of the visual or auditory centres in the brain can produce the sensations—the hallucinations—of unreal images and sounds; neither can we understand how a ray of light striking upon the optic nerve can produce real vision, or how a vibration of a medium upon the auditory apparatus can cause a normal sensation of sound.

The analogy between hallucinations of the senses and the delusions and other abnormalities of mind is very striking. Flashes of light before the eyes, roaring in the ears, a sense of crawling insects upon the skin, or convulsive movements of muscles in certain diseases of the brain, resemble the unreal mental impressions and morbid activities of delirium and insanity. The healthy eye and brain perceive an object when light from that object strikes upon the impressible nerve. The normal motion of a voluntary muscle is produced by an impulse of the will. A morbid excitement of a diseased visual centre will cause an abnormal sense of sight independent of light, and a similar excitement of a motor centre will cause muscular movements—convulsions—without an act of the will. In like manner morbid conditions of the intellectual part of the brain produce deranged mental activities—certain dispositions, feelings, emotions, opinions, determinations—proceeding from within; while in the healthy state emotions, opinions, and determinations are usually excited by some sufficient external influences, as reasons or motives—the actions, hav-

ing external relations, stand in certain reasonable and harmonious connection with the external, real world.

When a sane man is excited there is an external cause for the excitement, external to the central source of feeling, and operating upon it; but the insane man is excited from the morbid operations of his own diseased organs, or from an inadequate cause affecting them. In like manner a healthy ear perceives sounds only when vibrations of a medium strike its sensitive parts, while in disease of the organ there are ringing or roaring sounds without such vibrations, or slight external sounds are exaggerated or greatly perverted.

Deranged mental actions from wrong conditions of the brain—emotional, intellectual, or determinational—involve perception and usually consciousness, inducing false beliefs, false judgments, and absurd and irresponsible actions.

There are connections between the different forms of insanity—between those forms where the emotions, the intelligence, and the will are respectively the principal seat of the disease—and it is seldom that one department of the mind is affected without more or less participation of all other departments. Different cerebral centres are particularly concerned in the different classes of mental actions, but there is a sympathy between them so intimate that the disturbance of one affects the rest; and often all the centres concerned in mentality are simultaneously affected. Morbid conditions of these centres may produce irregular actions of every kind—irregular feelings, as in illusions and hallucinations of the senses; irregularities of ideation and thought, as in incoherence and delusions; irregularity of emotions, as in melancholy and morbid gaiety; irregularity of the propensities, as in kleptomania, dipsomania, impulses to homicide, suicide, etc.; irregularity in the action of the will, as in eccentric, fanciful, absurd, or vicious conduct; and irregularities in the whole mechanism of the mind, as in general mania or general melancholia.

So much space has been occupied in this general account of insanity in order to give the student such views as are thought to be essential to an understanding of its nature, and this will render the presentation of details less important.

No pretense is here made to a complete discussion of this subject even in outline. The object is to give such general views of mental physiology and pathology, and such practical suggestions respecting its diagnosis and management, as will be of most importance to the general practitioner.

ETIOLOGY OF INSANITY.

Many of the causes of this malady are suggested in the etiological

classification of Dr. Skae, and in other statements that have preceded, but some additional statement under this head seems to be required.

The causes contributing to the production of the affection are numerous and varied. Some are predisposing, some exciting, and others are merely accessory. As in other diseases the lines of demarkation between the different classes of causes are not clearly drawn, and it is not essential to keep up the distinction. The influences of *climate*, of *race*, of *nationality*, and of *civilization* are undoubtedly great, and have been extensively discussed. The subject, however, is complicated, many elements are concerned in it, and it need not be entered upon here with any particularity. The occupations, the habits, and modes of living, the education, the political institutions, the religious beliefs and practices, the conditions of property and business, the pursuit of wealth, or pleasure, or position, the content or discontent with situations, all have their effects in establishing characteristics and determining the amount of mental disease. Business, political and religious crises, and wide-spread emotional excitements are generally regarded as increasing the disease ; but it is sufficiently frequent in the stagnation of all these interests. Mental occupation and activity in civilized communities, if not too intense, by no means favor the production of the disease ; and statistics show that those whose religious emotions are reasonably active are certainly not more inclined to insanity than those who are indifferent to religion. The disease seems to increase as men depart from the simplicity of nature, but religion in some form is natural to the human race.

Proper *education*, a judicious mental training, so far from producing insanity strengthens the mind, and tends to its prevention in those who from heredity or other causes are predisposed to it. Injudicious education, cramming the undeveloped mind with abstruse or unsuitable knowledge, too great repression on the one hand, and too much indulgence of whims and passions on the other, tend to produce mental disease.

Social position and particular occupations have less effect than some have supposed, except as they influence other associated conditions, such as temptation to intemperance, excessive strain, discontent, etc. Insanity is about as frequent in the lower and middle as in the higher ranks of society, or at least the difference is not striking. The poor are subjected to privation and various bad hygienic conditions which impair their health and depress their minds, and thus lead to mental disease. The more wealthy and educated classes have their disturbing conditions—dissipations and various indulgences,—which injure their health ; and ambitions, rivalries, losses, and

vexations which disturb their minds. Many cases of insanity are furnished in this country from what may be called the American middle class—from the fairly well off—the industrious, the agricultural, and the higher mechanical classes. Women, especially from this class, with the cares of an increasing family, with a desire to maintain a position in their own society and to obtain a higher one, and with the laudable pride of showing a household well cared for, become overtaxed, ill, and exhausted. Their appetite and strength failing, while exertion is still demanded, they resort to strong tea and coffee, and sometimes to still more objectionable articles, to produce a temporary excitement and soothe their uncomfortable feelings, and, as they say, to rest them; the nervous system becomes irritable; sleep, which “knits up the raveled sleeve of care,” is diminished; the flesh is reduced, and the mind at length becomes depressed by deep gloom and apprehensions. From this to unequivocal insanity the transition is easy, and it is too often made.

It is about as frequent in one *sex* as in the other, as men are subjected to their own adverse influences, though there are more forms of insanity peculiar to women than to men.

No age is entirely exempt, though it is rare before puberty, more frequent from sixteen to twenty-five, but most frequent between twenty-five and fifty. In women during pregnancy, in the puerperal condition especially, during lactation, and near the menopause, it is more frequent than at other periods. From this statement respecting age, idioey and senile dementia are excluded.

The influence of *heredity* is decided. It is thought by those who have given special attention to the subject that in from one fourth to one half of the cases a hereditary predisposition can be traced, not always in the positive insanity of the relatives, but in some form of nervous disease or defect. Epilepsy, drunkenness, striking mental peculiarities, “crankiness,” hysteria, intermarriage of close relations, and various neuroses in parents, tend to produce insanity in offspring; and, as in other cases of hereditary influence, it extends to several generations.

The causes already enumerated are considered as *predisposing*. The particular *exciting causes* are still more numerous. Some are *moral*—operating directly on the mind—while others are *physical*—affecting primarily the body.

Mere intellectual exertion, though intense and long continued, and even when injurious to the health in other respects, seldom produces insanity. Immoderate grief or joy—any great mental shock—may suddenly develop the disease, especially in those predisposed to it; and great ambition, excessive vanity, and other imperfections of charac-

ter may by slow degrees induce the more morbid state of insanity. Vexation, sorrow, reverses of fortune, disappointed ambition, anger, hatred, unrequited love, remorse, religious depression (though this is more frequently an effect than a cause of insanity), a sense of responsibility, loss of friends, etc., may operate as exciting causes.

The *physical causes* are also numerous. This is to be inferred from the classification referred to. "Among these," says Dr. Bristowe, "alcoholic intemperance is doubtless the most important. Partly, it may be, from the emotional disturbances which are incidental to alcoholism, partly from the direct influence of alcohol in the production of diseases, and especially induration of the surface of the brain, the abuse of drink is a pregnant cause of insanity." It is doubtless a more frequent cause of the disease in England than in this country, as the practice of indulgence in the use of alcohol is more general there than here; but that it is a frequent cause with us the records of our asylums show. The effect of intemperance in producing insanity is less upon the drunkard himself than upon his offspring. "His habits may produce an attack of insanity when a predisposition exists, but he generally escapes with the loss of much of his natural vigor of mind. In the offspring, however, on whom the consequences of the parental vice may be visited to the third and fourth generation, the cerebral disorder may take the form of intemperance, or idiocy, or insanity, or vicious habits, or impulses to crime, or some other mental obliquities." (Dr. Ray.)

The habitual use of opium, chloral hydrate, tobacco, and other narcotics, tends to the same result.

Sexual excesses, especially in the form of the *solitary vice*, are not an unfrequent cause. There are several reasons why masturbation is more injurious than sexual intercourse. It is usually commenced at an early age, often much before the sexual function is fully developed, and long before it should be exercised. The opportunity is always present, and the temptation, especially with the young, to frequent repetitions is usually yielded to. The unnatural character of the act, deprived of the proper associated conditions, renders it more injurious; and much of its evil effect is due to a sense of shame and guilt—to the moral distress which the habit occasions. The opinion sometimes expressed, that masturbation is not more injurious than coitus, I believe to be erroneous, and in danger of doing much harm. There are exceptions to general rules. Individuals may have practiced this physical and moral vice with comparative impunity, but most who practice it are injured, many very seriously injured, physically, mentally, and morally.

The insanity of pubescence, of satyriasis, of nymphomania, of

hysteria, of amenorrhœa, of the puerperal state, of pregnancy, of lactation, and of the climacteric period in women, are all connected with the reproductive system, showing how profoundly this system affects the mind ; and any diseases of these organs in persons predisposed to insanity may develop the affection. A revulsion of the sexual instinct, which sometimes occurs just after marriage, is indicative of a change in the nervous system that often amounts to general insanity.

An enumeration of the other physical causes mentioned in the list of Dr. Skae need not be repeated. It is seldom that any of these exciting causes induce insanity unless the *insane constitution*, “the insane temperament,” or diathesis exists. From hereditary influence or from peculiarity of organization this may be so decided as to result in a full development of the disease without any special additional cause, mental or physical. It is probable that insanity is often attributed to particular causes that have had only a slight concomitant influence, and possibly none at all, in the production of the affection. There is usually a long train of circumstances exerting more or less influence tending to the result.

The cases in which the disease occurs spontaneously, or from mental or moral causes, and in which it cannot be attributed to any physical exciting cause, and is not connected with any other disease, are placed under the head of *Idiopathic insanity*. Such cases are not very common, but they not very unfrequently occur ; and in them the “insane temperament” is well marked, or at least is present, and a hereditary influence can generally be traced.

The cases depending upon particular physical causes, or occurring in connection with other diseases, have peculiar features depending upon such causes or associations.

Idiopathic insanity may take a variety of forms in symptomatic phenomena. There may be mania or melancholia—general or special—emotional, intellectual, or determinational insanity, and it may be either *sthenic* or *asthenic*. The *sthenic* form, accompanied with increased vascular action, with suffused eyes, throbbing temples and carotids, and hard and full pulse, occurring in persons of previous robust health, is usually preceded by exciting emotions or passions. The *asthenic* form is usually combined with symptoms of anæmia, emaciation, feeble pulse, cold extremities, etc., and is likely to be preceded by exhaustion, *want of sleep*, and other depressing conditions.

SYMPTOMS AND PROGRESS.

From what has preceded it will be seen that insanity is a complex condition, a perversion of mental action of different kinds and de-

gress, and that individual cases undergo various changes in their course. As the disease occurs in persons of different original characteristics, mental and physical, occupying a variety of positions and sustaining different relations, and is produced by so many different causes, we can readily understand that great variations in phenomena will be presented, and different courses will be pursued in its progress.

Disorders of sensation sometimes occur with the insane, though in many cases no such disorders of the outer senses are noticed. There may be anæsthesia, analgesia, or hyperæsthesia; or illusions of sight, of hearing, of taste, or of smell. Hallucinations are not uncommon, and are oftener of sight than of other senses; though hallucinations of hearing, especially where words are recognized, are of graver import than those of vision. Illusions and hallucinations of common sensation occur. Animals or fiends are supposed to be felt in the interior of the body; and such hallucinations are very common in relation to the reproductive organs of both sexes. In many cases of insanity, though various bodily organs are evidently suffering, the patient is free from the sense of illness, declaring himself well, and hence often protesting against medication. Various senses may be affected at the same time; but if the patient is so in possession of his reason that he recognizes them as false impressions, he is not necessarily insane. When, however, such false impressions are regarded as realities and acted upon, especially if the patient cannot be reasoned out of his opinions, but holds them in opposition to common sense, he is laboring under morbid delusions—is insane. To this statement there may be exceptions. In some instances, from education and associations, or under temporary mental excitement, unreal and even impossible appearances are believed to be true. Luther thought he had a visitation from a bodily devil, at whom he threw his inkstand; but Luther, though mistaking his fancy for reality, could not be regarded as insane. The holding of speculative opinions, however much at variance with the common sense of mankind, is not proof of insanity in the sense of a disease. In the vagaries of faith and skepticism everything has been believed and accepted, and everything has been doubted and rejected. Natural credulity, however excessive, cannot be regarded as mental alienation, or as the result of cerebral disease. Something more than credulity or skepticism is required to constitute insanity.

Intellectual disorders—Mental perversions—may include morbid conditions of the feelings or affections, of the emotional functions, the ideational faculties, and the action of the will. The feelings are most sure to be involved. The statement of Esquirol, that “there are

madmen in whom it is difficult to find any trace of hallucination [ideational perversion], but there are none in whom the passions and moral affections are not perverted or destroyed," is generally accepted. Perversion of feelings, as already stated, is in the great majority of cases the earliest indication of insanity. Perversions of the reasoning powers usually come later, but generally they come, and the whole mind is more or less deranged.

Mental peculiarities or eccentricities, weakness of intellect, or violence of passions, if belonging to the character, do not constitute insanity. Its essential condition consists in a change of characteristics—an alienation from one's former self—by disease of the organ of the mind. When from injury or disease the hopeful and happy man becomes despondent and miserable, the truthful and pure-minded becomes vicious, the amiable becomes malignant, the cautious reckless; when, without cause in the object, love is turned to hatred, confidence to suspicion, and gentleness to violence; when obscenity takes the place of modesty, and profanity of reverence, mental alienation has occurred; and, whether delusions are discoverable or not, insanity exists.

Certain faculties may be intact or even exalted, an unusual degree of vivacity and even shrewdness in some respects may be manifested; but generally intellectual weaknesses or perversions in various respects appear, the natural order and sequence of ideas are destroyed, there are incoherence and inappropriateness of thought and expression, and various delusions, though sometimes concealed, are usually manifested. The will is not able to fix the mind upon continuous trains of thought, though sometimes the same thoughts and expressions occur with continuous iterations.

Sometimes a train of conduct is pursued from a fixed delusion of some voice or supreme command, and means are systematically and skillfully used for the accomplishment of an end. Oftener the acts are performed from impulses which, for a time, may have been striven against, but which have become too strong to be resisted by the feeble or deranged will. In other cases the will, from its own perversion, determines insane acts, without overpowering impulse or the delusion of commands.

In fact, every possible perversion of feeling, thought, and determination may occur in different cases.

In *Melancholia* there is a profound sense of painful depression and gloom, and often an impulse to commit suicide. The fully developed condition usually approaches gradually, and the feelings for a time may be concealed, but at length they are so intense as to find expression. The patient mopes, avoids society, and soon speaks of the

destruction he expects. Delusions, often of a fixed character, sooner or later appear where the disease becomes fully developed, but it may stop short of that degree; or temporary improvement followed by exacerbations, may take place. The patient often thinks himself guilty of some crime for which he is pursued by officers of justice, or is to be arraigned at a higher tribunal. If religiously disposed, he often thinks he has committed the unpardonable sin. He may imagine himself possessed of the evil spirit, to be forsaken of God and all good, and doomed to perdition. At an early period of his gloom he fears bankruptcy and poverty, or thinks he has enemies seeking his ruin. Hallucinations of the senses usually accompany these delusions, and may be to a large extent the ground of them. A variety of morbid bodily sensations are commonly experienced, nutrition often suffers, and a depressed condition of the physical system is frequent.

The course of melancholia is generally chronic, and if recovery takes place it is commonly gradual; and if the symptoms continue in force more than a year, recovery very seldom occurs. Where recovery does take place there are likely to be relapses or other attacks. Other diseases occurring in the course of melancholia may either relieve or aggravate it.

A modified form of melancholia exists in the severer forms of hypochondriasis, though the ordinary forms of this affection are not usually considered as positive insanity. Hypochondriacs dwell upon their supposed or real morbid bodily states, creating or exaggerating them. Cases of melancholia with *stupor*, with *destructive tendencies*, and with more or less *excitement* (thus being complicated with a maniacal condition), are seen, each presenting peculiarities of phenomena.

Mania characterized by mental excitement, by intellectual vivacity and incoherence, by sentimental exaltation, and by a restless tendency to increased muscular action, may break out suddenly from febrile or other disorders, but its approach is oftener slow and preceded by depression. Its earlier stages are almost identical with melancholy, but its proper characteristics at length appear, though with varieties in special symptoms. The patient is disposed to wander about, to gesticulate with violence, to hold conversations with imaginary persons, often in a loud voice and with an excited manner. He is easily excited to laughter or anger, and these and other emotions often occur without any external cause. Feelings of ill health often accompany the approaching stages; but commonly, under the excitement, the patient declares himself well, and has a high opinion of his physical powers. His feelings are often exalted and gay, but he is sometimes sad, and not unfrequently ill-tempered, suspicious, or ferocious.

Oftener, perhaps, he is jovial, boisterous, vain, and arrogant; or he may be acquisitive, lascivious, or controlled by different appetites and passions. He may dance, sing, shout, pray, or blaspheme in quick succession, may adorn himself with trinkets, accumulate all sorts of worthless things, or may strip himself of clothing. There are generally illusions, hallucinations, and delusions, but that which is more characteristic of this form of insanity is the incessant, tumultuous, or incoherent flow of ideas. The inhibitory mental functions—the restraining, regulating faculties—seem to be in abeyance, and the mind rattles on like a clock without a pendulum. The motor force may not be increased, though action of an irregular character is much more rapid and demonstrative. In the less violent forms of the disease the patients may be quick of apprehension, ready in repartee, and brilliant in conversation. They resemble the half-intoxicated man whose restraining and regulating faculties are paralyzed by the narcotic even more than the fancy is excited, while the governing reason is dethroned. From a loss of proper appreciation of realities, from an insane exaltation of the muscular sense, though not of the muscular strength, and from a similar exaltation of the sense of intellectual power, the insane, like the tipsy man, thinks himself strong and brilliant while he is weak and foolish. His incoherent nonsense seems to him the perfection of exalted sentiment and expression. He fancies himself a Shakespeare, a Washington, or a Christ.

In pure mania these and all other feelings and opinions are likely to be variable and transient, while in monomania especially, and in melancholia also, fixed delusions are more common.

The course of mania varies in different cases. It may be continuous for a long period, it may be remitting or intermitting, and in some cases there are periodical alternations between mania and melancholia (*folie circulaire*). Recovery is sometimes sudden, complete, and permanent, occasionally in connection with some other disease, and if it occurs at all it is likely to be within a year, though sometimes it terminates after two years; but when it continues longer than that period recovery is rare. The protracted cases are subject to remissions or marked variations in the phenomena.

Delirium tremens is classed by some under the head of mania, while others regard it as a species of delirium; but it is a peculiar affection, and has already been described.

Nymphomania, Satyriasis, Puerperal Mania, and *Mania sine delirio*, have each marked peculiarities in symptoms and course. The term *Moral Insanity* has been applied to perversion of feelings and impulses, when throughout the disease no evidences of delusion or perversion of strictly intellectual operations are manifested. There

has been much dispute as to the existence of such a state, and though it is exceedingly rare, cases have undoubtedly been observed where, for considerable periods, no intellectual perversions have perceptibly cropped out, though morbidly excited feelings and uncontrolled, if not uncontrollable, impulses have governed the patient. The patient apparently understands and reasons like a sane man, but is changed in his social and moral character. He neglects or abuses his family, to whom he has been previously devoted and kind; though previously abstemious, he takes to drink; and though formerly moral, he becomes criminal. There is probably, in such cases, more or less intellectual abnormality, but it is not conspicuous, while the principal change is in the moral perversion. The question of responsibility in such cases is one difficult to decide; but when the insanity is the result of disease for which the patient is not responsible, and is so decided as to destroy the freedom of the will, responsibility is certainly diminished, if not completely destroyed, and punishment for crime should at least be mitigated.

Monomania is a term applied to a state in which the alienation pertains to one or a few subjects. The monomaniac has usually exalted notions of his own importance, and entertains fixed delusions on particular subjects which dominate his thoughts and conduct. There is not the profound and persistent depression which characterizes melancholia, nor the versatile incoherence of ideas or the restless vivacity of movement which distinguish mania. While there are fixed delusions of the special kind, there is a power of reasoning, a persistence of purpose, and a control of actions which admit of the consistent pursuit of a particular object. The subjects of the delusions are very various, and the conduct of different patients presents many contrasts. One may be arrogant and overbearing, another affable and condescending. One will be scrupulous in dress and appearance, another careless and slovenly, while still another will indulge in fantastic attire. Some, however, will show nothing unusual in their dress or demeanor, and will appear much like others unless the subject of their delusion is introduced, when their aberration will be manifest. Sometimes, knowing that others regard their notions as delusions, they will conceal or even deny them, though holding them with unwavering firmness. Generally their delusive opinions seem to them so certain and consistent, that they maintain them on every occasion when questioned.

Monomaniacs may be harmless and quiet, though if thwarted they are apt to become violent, and sometimes, without provocation, they become excited and dangerous, and may pass into a condition of general mania.

When a state of monomania has existed for many months it is very likely to continue, sometimes for long periods, or to pass, as in most cases it does in time, into dementia. Patients may live to an advanced age in this state, as the bodily health is often good.

The term *Dementia*, used in its technical sense, indicates mental deterioration or decay—a loss of mental power rather than a qualitative perversion. There are no restless activities or violent impulses, no gloomy forebodings, or the pursuit of special objects. There is usually passive submission to the control of others, and though silly laughter and causeless weeping often occur, there seems but little real pleasure or grief. Dementia is sometimes primary from pronounced disease of the brain, or from the decay of age, but it is the usual termination of incurable mania, melancholia, and monomania, and is therefore commonly secondary to these forms of insanity. In primary cases there are frequently no delusions, but simple loss of memory and mental power. In secondary cases the delusions usually continue, and constitute the centre of such thought as remains. The demented often mistake objects around them for their dead or absent friends, they are apt to repeat formulæ, may pace incessantly a particular round, generally become filthy in their habits, and sometimes are mischievous in their conduct. In some cases of dementia the mind is almost a blank, only fragments of ideas and delusions play upon its surface, the memory is nearly gone, ideas of personal identity are lost, their own names are forgotten, and in the most advanced cases the mind is almost entirely annulled, and even more than the helplessness of infancy supervenes. Scarcely more than a vegetative life continues, and the term *Amentia* becomes applicable. Even in this state the bodily health may remain comparatively good, and life for years may continue.

In each of the different forms of insanity there are minglings of the elements that belong to other forms, and the lines of demarkation are not clearly drawn between them; and cases occur which could scarcely be placed in any distinctive symptomatic class. Cases must be individualized, and in some instances the most that can be said, in expressing a diagnosis, is that the person is insane. This in courts, or for the purpose of restraint, is generally sufficient; though in sending to an asylum it is well to state, if that be the opinion, that the patient is dangerous to himself or others.

General Paralysis of the Insane—a complication of bodily and mental disease—is quite distinctive in its character and phenomena, and requires a separate notice. It has a well-recognized anatomical basis, consisting in an inflammation of the gray surface of the brain; it is clinically associated with a peculiar form of mental aliena-

tion, and there is a progressive paralysis of the voluntary muscular system.

It is attributed to different causes, such as venereal excesses, overwork, anxiety, mental shock, and physical injuries; but perhaps oftener than to any of the others to the free and long-continued use of alcohol.

There is usually a period of some months' duration, in which the feelings and propensities of the patient are more or less modified. His moral and social character is changed. He is restless, irritable, ready to take offense and become violent, and sometimes engages in reckless speculations or gives himself up to debauchery and different forms of dissipation, or to acts of crime.

In time the distinctive character of the disease becomes manifest. The patient may be taken with an epileptiform or apoplectiform seizure, after which a maniacal excitement will appear, with delusions of personal magnificence or of great possessions, with some difficulty of speech and trembling of lips. There may be improvement for a time until another fit occurs, when all the symptoms will be aggravated. Instead of such a fit there may be an outbreak of mania. In some cases the delusions of great wealth and high position may be early manifested, and extravagant expenditures will be indulged in, which might be becoming such wealth and position as he fancies he possesses, but which are entirely unsuited to his actual state.

In other cases symptoms of paralysis precede those of mental alienation. Muscular power is gradually lost, trembling occurs, first in the lips and tongue, and after in the limbs; at length the impairment of power is great, and much agitation may take place when attempts are made to move, either in speech, manipulations, or locomotion. He stammers and blunders in the use of words, he is obliged to give up writing; and with this loss of motor functions there is generally more or less loss of sensibility.

In a large majority of cases the mental phenomena are still more striking than the physical, and may precede them in time. The perversions of feelings, of impulses, and of moral conduct already mentioned become exaggerated, and all sorts of extravagances, absurdities, and outrages may be committed. Sooner or later the peculiar delusions of importance and wealth are manifested. At first his position may be but moderately advanced, and his income and possessions may be simply doubled. Soon he fancies himself some greater personage, and his wealth is quadrupled. At last, from being a president, a king, or an emperor, he becomes the governor of the universe, and has ship-loads of gold or ear-loads of diamonds.

These delusions generally keep pace with the increase of physi-

cal symptoms. The greater the paralysis and mental and physical degradation, the greater the fancied importance, power, and wealth.

In the last stage of this progressive disease the patient has lost the power of locomotion, the power of speech is annulled, the ability to feed himself is gone, evacuations are passed without his notice, he recognizes no one, expresses no wants, but he swallows food when it is put into his mouth; his digestion may be sufficient, and his flesh may be kept up for a long time. At the last, emaciation may result, bed-sores may occur, and diarrhœa, pneumonia, or phthisis may close the scene; or the patient may die of exhaustion, or from asphyxia, from impaction of food upon the glottis, or from apoplecticiform seizures, ushered in by excitement and elevation of temperature, sometimes presenting symptoms similar to those of uræmic poisoning.

The course of this disease is almost uniformly from bad to worse, though sometimes temporary improvement occurs. Many years ago I was shown a case in Paris, in which the patient, an engraver, after a development of the disease, was so far recovered as to draw figures with some degree of accuracy. The case was anomalous, and I have never seen such an one since.

Idiocy is a condition of congenital dementia; or at least one in which the intellect has never been developed. There are usually no delusions, as in dementia, secondary to other forms of insanity. It has different degrees, from mere feebleness of intellect or imbecility to a state in which scarcely a glimmer of intellect is perceptible.

It generally depends upon some anatomical defect, some want of development of the brain during uterine life, or upon some accident or disease in infancy or early childhood. It is sometimes the result of convulsions, of inflammation of the encephalon, and is very commonly accompanied by some physical deformity or defect. It is frequently a consequence of drunkenness in the father or mother, or of other serious constitutional defects in the parents; and a form of idiocy, accompanying goitre, called cretinism, abounds in particular localities, as in some of the valleys of Switzerland. It is not unfrequently complicated with epilepsy; but some idiots are in good health, though they seldom live to old age. Occasionally an idiot is possessed of some lower mental endowment in an extraordinary degree. The power of imitation may be great, and occasionally there may be much physical strength and agility. With some imbeciles much improvement may be effected by education and patient, systematic training, and a large degree of comfort, and even usefulness, may be secured, where from neglect or bad treatment much suffering and extreme degradation would result.

DIAGNOSIS OF INSANITY.

In most cases of insanity, when severe in form and fully developed, the diagnosis is easily made. It must, however, be understood that in this, as in other diseases, physiological functions pass so imperceptibly into pathological that the line of demarkation is sometimes but imperfectly defined. There are, besides, cases where the insanity is concealed, others where the disease is feigned, and, as just intimated, there is a border land between sanity and insanity—between folly or wickedness, and disease—a region of “crankdom” (to borrow a modern expression), where the lines of demarkation are so obscure that the most expert may fail to discover them.

There are no positive tests, physical or mental, which can be applied—no physical condition upon which insanity can certainly be predicated. Peculiar expressions of the eyes and countenance, certain more permanent forms of the features, particularly of the ear, a coarseness of the hair, a special odor of the person, and other changes perceptible to an accurate observer occur, especially in the marked cases of chronic insanity; but such indications are often absent or not conspicuous, especially in the doubtful cases, in the milder forms, and in the earlier stages of the disease. When such appearances are present they are to be taken into the account; but insanity must be discovered, if discovered at all, by observing the mental manifestations, comparing them with the former condition of the patient, and considering them in connection with the bodily states which will aid in the diagnosis.

If the recognition of this disease even by specialists and experts is sometimes difficult, much more will it be difficult to give any descriptions which will enable the reader, without experience, to distinguish it in doubtful cases, for it is a disease which is to be *seen* and recognized rather than described. The family physician is usually the first to be called to a case of suspected or approaching insanity, and an early diagnosis is of great importance in order that proper precautions may be taken to prevent accidents, injury to the patient or others, and that proper treatment may be instituted.

Among the earliest symptoms in commencing insanity is *want of sleep*. This, to a greater or less extent, is very generally present. Pain or heat of the head, throbbing of the carotids, and suffusion of the face and eyes are also common. Then alteration in the emotional state appears. Depression of feeling is most common, though there may be excitement. There is not unfrequently greater susceptibility to impressions, and sometimes unusual gaiety. Then will follow hallucinations of the senses, which at first may be recognized by

the patient as unreal appearances, but at length are regarded as realities. Absurd opinions, groundless suspicions, ideational delusions, false judgments, perversions of the will, and unusual or absurd or dangerous conduct complete the development of the disease and make the diagnosis clear. Though cases are not so clear, a further description of the phenomena by which insanity is to be distinguished will not be attempted. It must be borne in mind that it is a disease of the brain and nervous system, and is to be distinguished much as other diseases by comparing the condition presented with the normal state, and in order to do this the normal state must be known. This may require much care in obtaining the history of the individual, and may also require repeated observations of his present state and of his conduct under different circumstances, and an opinion in an obscure case should not be given without ample opportunity for investigation. Indeed, the physician in ordinary practice who has not seen much of insanity should be cautious in expressing opinions in controverted cases, and will secure more respect for science and the profession by expressing doubts where they exist, and by frankly admitting a want of the proper premises for a conclusion, than by declaring opinions which have not an ample or even a sufficient foundation.

Among the conditions with which acute insanity may be confounded are delirium ebriosum, delirium tremens, and the effect of some narcoties—such as belladonna, stramonium, opium, chloral, and hasheesh—the delirium of fever, hysterical excitement, extreme enthusiasm, and malingering or feigned insanity. Chronic cases may be mistaken for mere eccentricity or wickedness, the result of a depraved nature or of bad education and associations. The effects of the narcoties have each their peculiarities, which are usually recognizable, and the history of the case will aid the distinction. So of the delirium of fever and the peculiarities of hysteria. Enthusiasts, however excited on a particular subject, will be rational on others, and the eccentric man has strong individuality, usually consistent and persistent. He is self-reliant, his peculiarities do not partake of the character of insanity, and he is no more likely than others to become insane.

When the question is between wickedness and moral insanity, something more than the mere fact of the commission of the crime, however heinous or apparently motiveless, must be found to establish irresponsible insanity. There must be evidence of *disease*, of alienation by it from one's former self; and the previous history and subsequent course of the person must be considered in order to determine such change.

The other ordinary symptoms of insanity—a disposition to do

other violent or absurd things such as would lead to extraordinary acts, must be found. If the attack is claimed to be a sudden and violent one, the pasty tongue, the foul breath, the constipated bowels, the furtive watchfulness, the disturbed pulse, the sleeplessness, and the disturbed digestion should be present. If it is claimed to be chronic, the time of the alteration must be shown, and other insane acts will have occurred. A long continuance of insanity without unequivocal insane acts is very unusual, if not unknown.

It will often require much tact, discrimination, experience, and judgment to make the proper distinctions, and eminent experts not unfrequently disagree. Caution and reserve may well become one whose opportunities have not enabled him to become an expert in the disease.

PROGNOSIS OF INSANITY.

The prognosis will vary greatly in different forms of the disease, and will depend much upon the period in the progress of the case in which the observation is made. In a majority of cases insanity is not directly dangerous to life. The general prognosis is not as favorable to recovery as most of the statistics of asylums might lead us to conclude. By the investigations of Dr. Pliny Earle, of the Northampton Insane Asylum, Massachusetts, it has been shown that many cases have been reported as cured where the disease was only suspended for a time, and that the same patient has served repeatedly to swell the list of cures in the same or other institutions, and has finally died insane.

The International Congress of Alienists, which met in Paris in 1867, made a classification into *Curable* and *Incurable* varieties of insanity. In the curable were placed insanity of pregnancy, childbirth, lactation, climacteric insanity, insanity from uterine disorders, from tuberculosis, from masturbation, from alcoholism, post-febrile insanity, and hysterical insanity.

The incurable cases comprised general paralysis of the insane, epileptic insanity, senile insanity (senile dementia), and paralytic insanity (organic dementia).

All cases placed in the curable list are by no means cured, but there is a probability, or at least a possibility, that some may recover, while there is scarcely a hope of any recoveries among those in the list of incurables.

The chance for complete and permanent recovery for a patient who has remained insane for more than a year is comparatively small, and when relapses have occurred they are likely to be repeated. Still,

many recoveries take place, and few cases should be abandoned as absolutely hopeless.

The cases most likely to recover are those connected with child-bearing. Where, in any case of insanity, however, there is a strong hereditary influence in the causation, permanent recovery can seldom be hoped for, whatever form the insanity takes. Idiocy is, of course, hopeless as to the possession of a sound and active mind, though, as before stated, in many cases great improvement may be produced by proper training.

Proper treatment, medical and especially moral, has much effect in improving the condition of the insane, where it fails to effect a cure; and no class of patients have higher claims upon the community and the profession for the most tender and skillful care.

The prognosis as to the continuance of life will vary greatly in different cases, and no general statement will convey precise information. Some are soon exhausted by the intense excitement or terrible depression, or are cut off by intercurrent disease, while others live for years; great age, however, is seldom attained by the insane.

Phthisis is a frequent complication, and sometimes the phthisical symptoms replace many of the phenomena of insanity. Alternations of such symptoms are sometimes noticed. When those of phthisis are active the insane phenomena are in abeyance, and when after a time the maniacal symptoms return, the phthisical symptoms abate. Destructive changes, however, go on in the lungs, and the termination is the same as in other cases of consumption. Constipation is frequently present in insanity, derangements of the liver functions are not uncommon, diseases of the heart, of the stomach and intestines, a displaced colon, chronic peritonitis, uterine affections in the female, and epilepsy and various other diseases of the nervous system are more liable to occur in the insane than in an equal number of the sane. All such complications tend to shorten life, but the simple condition of insanity is seldom speedily fatal.

The prognosis is varied by the particular form the insanity assumes. General paralysis commonly goes on to a fatal issue within two years. Acute mania may go on to exhaustion and death in a short time, especially where food is refused and not properly administered. If the temperature rises several degrees, if there is motor paralysis or eclampsia, organic complications are indicated, and there is more danger to life. Genuine epilepsy, though unfavorable to recovery from the insanity, is not so unfavorable to life, yet death in epileptic fits occasionally occurs. When there are suicidal impulses there is great danger of self-inflicted death. The purpose is apt to be concealed and accomplished, unless great care is taken to prevent it. In

whatever form of the disease, the more recent the outbreak the better the chance of recovery. When the case goes on and secondary dementia occurs, intelligent hope is gone.

After puerperal and hysterical insanity, acute melancholy and acute mania are in this order more favorable, while chronic mania and monomania are less so. When a melancholic patient believes the cause of his suffering to be in some external agent, he is less likely to recover than when he attributes it to something within himself.

A homicidal patient who believes himself a victim of persecution seldom recovers, while the suicidal is more likely to recover, especially after some serious and nearly successful attempt upon his own life. Acute primary dementia is much more hopeful than the chronic secondary form. Slowly approaching cases of insanity are less favorable than those produced suddenly by shock. There is much more hope when the form of the disease changes than when it persists in a more uniform course. Hereditary cases often recover, but are very liable to return. In acute mania from drunkenness or opium eating, the prognosis is favorable if the habit is permanently abandoned. It, however, seldom is so. When steady intemperance results in dementia, serious organic changes have occurred and the prognosis is unfavorable.

In insanity from long-continued sexual excesses the prognosis is unfavorable. If it is caused by religious excitement purely, recovery may be confidently looked for. The younger the patients, as a rule, the more hopeful; but insanity before or just at the time of puberty is usually hereditary, and a recovery is not likely to be permanent.

PATHOLOGY AND MORBID ANATOMY OF INSANITY.

The intimate pathology and morbid anatomy of insanity, in the present state of knowledge, are most unsatisfactory. That mental functions depend upon the brain, and that morbid conditions of these functions depend upon disease of the brain, we have seen abundant reason to assert. But at present too little is known of the intimate constitution of brain elements and the mode of their functional activity in health, to enable us to understand the morbid processes which occur in disease. The subtlety of nature so far exceeds the subtlety of human investigations that there are, doubtless, many molecular and chemical changes which our present coarse means do not allow us to discover. Great advances have been made, and are still being made, in the knowledge of minute structures, and of changes of tissues in disease, but not sufficient to furnish knowledge of the kind of changes which produce all the different forms of madness, and

in some cases experts in pathological anatomy have failed to find any changes at all.

This is true in some other cases of disease as well as in those of insanity. A dose of morphine or prussic acid may completely suspend nerve action and cause death without the fact being accounted for by any discoverable changes in nervous structure. A powerful emotion may cause instant death, but without leaving behind any detectable structural change. But the instances of death during the course of insanity where no changes are discoverable are becoming less as the means of investigation are becoming more perfect.

The primary change in insanity may be in the individual nerve elements, or in the quality or supply of blood. The nerve elements may be changed injuriously by various means—by overwork, emotional excitement, poisons in the blood, direct injuries, etc.—producing disturbance of function. Disturbance of circulation will follow, increasing further the disturbance of function. When there is an innate feebleness or peculiarity of the nerve elements from hereditary taint, disease of the brain action—insanity—may be caused by influences which would produce no such effect in more vigorous and healthy constitutions. In the disturbance of the circulation there may be either superabundance or deficiency of blood in the brain, and either of these conditions may be secondary to changes in the nerve elements.

Delirium—a kind of brief insanity, in which there are illusions, hallucinations, delusions, and incoherence, as in more permanent alienation—is often caused by acute anæmia of the brain; and in congestion of that organ, as we have seen, the apparent excitement of mental operations may be due to a deficiency of oxygenated blood circulating through the capillaries, producing suspension of inhibitory functions rather than direct excitement of brain cells. When there is excess in pressure of blood, or hyperæmia, diverting the blood from the brain or abstracting it from the system may produce relief, at least temporarily; but insanity proper, certainly when it has become established, is very seldom accompanied by hyperæmia, or at any rate by a condition requiring blood-letting.

When insanity has once occurred—when the brain has acted in an irregular manner, and a habit has been established—it is very likely to do so again. Besides, the “insane temperament,” which in most cases of insanity is more or less marked, is permanent or constitutional, and is liable at any time to manifest itself under slight disturbances, or without any particular exciting cause.

The phenomena of insanity may alternate with other nervous affections, with convulsions or neuralgia, the derangement of the motor

or sensational centres being apparently transferred to the emotional and ideational centres. Diseases of other parts of the body, especially of the digestive and generative systems, disturb the functions of the brain, and become causes of insanity in those predisposed to the affection; but none of these observed facts serve to explain the intimate character of the disease.

Various *post-mortem* changes are found in connection with insanity, but the relations of these changes to the phenomena of the disease are by no means always clear. Very great pathological changes may occur in the brain without producing special disturbance of the mind, much less the peculiar organized disturbances constituting specific insanity.

Severe traumatic injuries, morbid growths, and even softening and abscesses may occur in the brain without producing serious disturbance of the mental powers. But they occupy limited portions, are usually unilateral, and do not involve large portions of the surface ganglia, where the mental functions are at least chiefly situated.

Still, insanity sometimes accompanies tumors, softening, abscesses, etc., when central. But in these cases the surface cerebral cells are affected secondarily, though not necessarily. Where the "insane temperament" is not present the mental disturbance is of the character of delirium or imbecility, rather than of organized insanity. There is shattering of the mental fabric, or a suspension of the actions, rather than any definite arrangement of its morbid activities.

There is a similar difference between clampsia and epilepsy, or between irregular muscular action from certain diseases of the spinal cord and chorea. The latter has been called insanity of the muscles.

The surface of the hemispheres and the membranes covering them are the parts that most frequently present evidences of change in insanity. In acute maniacal excitement proving fatal, hyperæmia of the pia mater, and discoloration, and softening of more or less of the cortical layers are observed. In acute melancholia there is less hyperæmia, but often there is effusion, and more frequently than in mania no marked changes are perceptible.

The cases of chronic insanity where all traces of disease are imperceptible, even by coarse methods of investigation, are rare.

Thickening and opacity of the arachnoid, and in advanced cases atrophy of the brain, especially of the convolutions, effusions into the subarachnoid space, discoloration of the cortical substance, and general hardening of the white substance, adhesions of the pia mater to the brain, especially in general paralysis, and in insanity after epilepsy and drunkenness, are among the appearances most frequently seen. In general paralysis of the insane more conspicuous and uni-

form changes are present than in other forms of insanity. Hyperæmia of the tissues, œdema of the membranes, effusions, wasting of brain cells, thickening of connective tissue, degeneration of arteries, atrophy and other changes of the whole brain, extending also to the spinal cord, and often still other evidences of inflammatory and degenerative changes are readily observed. There is no positive uniformity, however, even in this form of insanity.

The specific gravity of the brain is usually greater in the insane than in others, and is due to morbid deposits of albuminous and fibrinous substances which afterward contract. There is usually a decided increase of connective tissue at the expense of the proper brain elements.

There are changes in the vessels causing hindrance of proper nutrition, atrophy of nerve elements, and metamorphosis—usually proliferation—of connective tissue, as the most noticeable anatomical conditions. But other evidences of inflammatory changes, of fatty, amyloid, pigmentary, and calcareous degenerations, hypertrophy of the walls of vessels, twisting of arteries, vacant spaces in the brain tissue, and various minute changes in the cells and tubes are discovered.

It is alleged by some who have made special and repeated examinations of the brains of the insane with the higher powers of the microscope, and the improved modern methods of preparing specimens and of minute investigation, that changes of one kind or another are always found in the brains of the insane; but it is not within the scope of this article to attempt a particular account of the details which have been reported. The pathologists are only upon the threshold of this important subject; observers still differ on many points, but great advancements have been made, and there is reason to hope for much greater increase of our knowledge in the future.

It must be borne in mind that there are changes of action which leave no traces of change of structure. Changes in the vessels, excess of connective tissue, atrophy of brain cells and tubes, thickening and ossification of membranes can be seen; but the atony or excitement which exists before death we cannot see when the dead brain is before us. To add to the uncertainty of the relations of insanity with structural changes, it is more than probable that many of the pathological conditions of the brain found in those dying insane, are accidental and not specially connected causatively with the insanity. This is believed to be specially true of the condition of softening.

Says J. F. Dickson, M.D., Lecturer on Mental Diseases in Guy's Hospital, etc. (*Science and Practice of Medicine in Relation to Mind*, p. 385): "I know of no form of insanity which can be said to be the

result of softening of the brain. * * * Red softening occurs from passive congestion, which follows an arrest of the blood stream. Red softening, too, may result from active congestion, and appears in circumscribed patches which would speedily go on to abscess, as may be seen in acute inflammation, or in cases of hyperæmia, but the condition is usually secondary, and rarely produces symptoms of insanity. Yellow softening occurs from the cutting off of the nutrient supply, as by plugging one of the arteries of the brain with an embolus; associated with this we sometimes see loss of memory, and more or less fatuity; white softening of the brain is the result of œdema; but none of these states gives rise to a special form of insanity, though any of them may be and sometimes is found in the *post-mortem* examinations of insane subjects. That which is popularly called softening of the brain is, I believe, paralytic dementia; the condition of the brain is one of atrophy, and not of softening." To this clear and correct statement particular attention is called. Softening of the brain is a secondary effect of other pathological states, as we have seen in the account of cerebritis, embolism, etc.; but the general failure of mental and physical power often attributed to softening, as though it were a primary disease, is oftener a sclerosis, or a condition of œdema or atrophy.

From this account of the morbid anatomy of insanity it must be inferred that at present the essential structural changes—those necessary to the disease—are not conspicuous or clearly defined as to their character or locality; and that there is scarcely any particular condition of the body discoverable, either before or after death, which is conclusive evidence of insanity, and much less of the particular forms and extent of the disease. Discovering certain structural changes of the brain will, however, afford presumptive evidence of the existence of mental disease; but the observed mental phenomena must afford the *chief* evidence of such existence, and to a still greater extent of the degree and kind of mental unsoundness present. An examination of the state of the brain or other organs of the body after death can seldom or never be fully relied upon as settling the question of the legal capability or responsibility of the person during life.

THE LEGAL RELATIONS OF PERSONS OF DISEASED MINDS.

There are two views of insanity presenting themselves—namely, the strictly medical view of it, as a disease requiring treatment, and a legal view, as a condition incapacitating an individual for performing his duties and incurring his responsibilities, and often as rendering him dangerous to himself and others. This latter view opens up a

great variety of questions, into the details of which there is not space to enter. We are here chiefly concerned with the medical view ; but the physician called upon to advise in an attack of supposed insanity has first to determine the existence of mental disease, its character and extent, and next to determine what is best to be done for the patient, including the question of personal restraint, of sending him to an asylum, of determining his ability to transact business, etc., as well as the question of the medical treatment to be prescribed. The means of distinguishing insanity have already been described, and the course of medical treatment to be pursued will be mentioned further on.

The question as to the restraint necessary to be exercised will at once require consideration. A person showing evidence of insanity should be immediately placed under observation and the supervision of persons capable of exercising control or restraint, should it be necessary. This is imperative in all cases where there is reason to fear injury to the patient's self or to others, either in person or property. In cases of maniacal excitement, or of pronounced melancholy, or where particular injurious impulses are manifested, the patient should not be a moment away from observation ; and, indeed, in all cases watchfulness and care are demanded. The disastrous results which have followed in so many instances the neglect of such precautions render it important to emphasize these directions. Surveillance should appear as little obtrusive as possible, and restraint, should it be necessary, must be as mild as it can be, and yet effect the object of preventing injury or alarm. The law everywhere allows of such temporary restraint by neighbors, friends, or the physician, as seems necessary for safety or propriety. Temporary confinement in any secure place, with proper humane treatment, is not only justifiable but demanded where acts of violence are threatened or attempted, and where proper persons for exercising the necessary restraint without such confinement are not at hand.

It should, however, be borne in mind that personal liberty belongs to each individual who cannot be shown to be in a state of mental aberration, and that restraint for a much longer period than may be necessary to determine by legal measures that restraint is proper, may subject those exercising it to action in law for depriving a person of his liberty. As long, however, as an insane person is properly cared for by his family or near relatives, the public has no right to interfere, and the friends can only be called to an account when it is claimed that the person has been improperly deprived of his liberty, or has in some manner been improperly treated.

As to property, the insane person is regarded as a minor, and guardians, as for minors, should be appointed for its management. In

some of the States there are very few enactments respecting the care of the insane, and, as in cases of bodily illness, the friends are left to the duty of caring for the patient and using such measures as may be necessary to keep him from harm and promote his recovery. In nearly all the States there are now public insane asylums supported by the State and under the government of statutory provisions, and laws are enacted to regulate admissions to such institutions. As a rule, the sending or not sending an insane person to such institutions is left with his friends to determine, so long as the person is properly secured and cared for, and does not become a source of public annoyance or danger. As a matter of police, the law always provides for the care of the homeless or those not otherwise cared for, and who are permitted to roam about endangering the lives and property of others.

By the laws regulating the admission into asylums, the testimony of physicians is chiefly relied upon to determine the fact of insanity and the propriety of admission to the institutions ; and while in them the officers of the asylums have the care and management of the patient under certain prescribed rules.

In all the preliminary matters of determining the question of restraint, and of sending the patient to the asylum, the attending physician must take a prominent part. He is also, in cases of dangerous illness, often called upon to witness a will, or to advise as to the competency of the patient to make a will, and is frequently called into court to give testimony respecting such competency ; and under various circumstances, regarding contracts or criminal acts, to give testimony as to the question of a sound or unsound mind in the person, and the character and degree of that unsoundness. The physician, then, cannot avoid the subject of mental disease, and hence the importance of giving it his attention.

The laws of different States vary as to details—as to the method of placing an alleged insane person in an asylum, of the conditions of a discharge from detention or guardianship, as to the courts and their proceedings in determining judicially the facts—but the certificates and testimony of physicians are the chief foundations for legal decisions.

Physicians are liable to be called into court as *experts* in contested cases, and, unfortunately, when employed by contending parties, a bias having been given to the witness by *ex-parte* statements, differences are likely to occur in the testimony given which tend to destroy confidence in professional opinions. The physician who has had charge of a patient, alleged to have been at the time of unsound mind, cannot avoid appearing in court, and should not be unwilling to do so, to give testimony as to facts within his knowledge. He may, however, avoid being called as an expert, and should, as a rule, do so, unless he

has given much attention to the subject and feels competent to sustain himself under a rigid cross-examination. To an expert, hypothetical questions are generally put respecting the evidences of the existence of insanity, of the degree of disease which will render it proper to place a person under restraint or guardianship, or in an asylum, or to deprive him of the control of his property, or to declare him incompetent to make a will or a contract, or to excuse him from punishment for a criminal act.

The first requisite with the medical expert, in such cases, is that he understand the subject of insanity—the physiology and pathology of the mind—the recognized varieties of the disease, its diagnosis and prognosis, and everything pertaining to it. It is important to know the preceding history of the supposed case, or of the individual whose sanity is in question—his previous or concomitant diseases, his eccentricities, if he has any, his temper, and his moral and religious tone and character. Irrelevant questions are likely to be asked, which he should generally refuse to answer. If asked to do so, he should furnish an explanation, if he can, for any proven facts which seem to be contradictory. If one witness testifies that the person conversed with him on certain subjects in an entirely rational manner, and another testifies to conduct and appearances indicating mental unsoundness, the expert may explain that many insane persons will converse rationally on many subjects in the presence of strangers, and yet be laboring under delusions which on another occasion they might manifest.

The medical witness has nothing to do with questions as to what the law is or should be, but he may say that the capability of distinguishing between *right* and *wrong* is no proper test of the existence of mental disease. A lunatic may have perfectly distinct perceptions of right and wrong, not only in the abstract but as to the particular act in question—he may know it is contrary to law, and according to law deserves punishment—and yet by disease he is impelled to the commission of the act. The strength of his diseased impulses may control his enfeebled or perverted will. It is exceedingly difficult in some cases, where there is a clear knowledge of right and wrong, but where there is evidently mental disease, to say whether that disease is sufficient or of a character to render the patient irresponsible. The witness, however, has only to state facts and principles; it is for the court and jury to decide the question of responsibility. The medical witness may testify as to the conditions of the alleged lunatic he has seen, and, as an expert, may inform the court and jury of facts and principles which his studies and experience have placed in his possession; and, if asked and permitted, may express opinions respecting supposed or actual cases; but his chief business is to state scien-

tific facts and principles, leaving to others their application to the case in hand.

It is scarcely necessary to say that a witness should be free from all partisan feeling in the case, and should state clearly and frankly "the truth and the whole truth" (so far as permitted), whichever side in the contest it may favor. Deliberate intelligence, evident firmness, moderate earnestness, and self-possession will go far toward shielding a witness from successful efforts on the part of counsel to confuse, entangle, and browbeat him. Care must be taken that no admissions are made from which conclusions can be deduced at variance with what the witness believes to be the truth, and which he may have already stated. The witness should confine himself to the matter in hand, and decline to answer irrelevant questions. A calm appeal to the court will usually protect him from giving answers to such questions and from great abuse. A question is sometimes asked and a direct answer of *yes* or *no* demanded, where such a direct answer cannot be given without conveying an erroneous or imperfect impression. The witness should then claim his right to answer in his own way, and to make the necessary qualifications in order to convey an impression of the truth as he understands it.

All such questions as these: Is a man insane who does so or so?—describing particular acts. Does want of self-control indicate insanity? Will or will not wounds of the brain (or any other particular cause) produce insanity? etc., etc., should be regarded as irrelevant, and, as a rule, no attempt should be made to answer them.

If experts were summoned and examined by the court instead of the litigants, there would be much less danger of partisan bias, less disagreement among expert witnesses, and generally the truth would be more speedily, and, in many cases at least, more certainly reached.

As the form of proceeding for sending an insane patient to an asylum differs in different States, and as different asylums have different rules, no specific directions applicable to all cases can be given.

Generally a sworn certificate from two respectable medical men, stating that the person is insane and is a proper subject for care and treatment in an asylum, is required. All the formalities can readily be learned from a judge of probate, or from the officers of the asylum to which the patient is to be sent, who will generally furnish blanks to be filled out, with other proper instructions.

MANAGEMENT OF THE INSANE.

When called upon for advice and aid in reference to the care and disposal of a person supposed to be insane, two questions present

themselves : first, whether the person is or is not of unsound mind ; and secondly, whether he is a fit and proper person to be detained under care and treatment as an insane person in his home, in a private house, or in an asylum. In the delirium of fever and various acute brain diseases there is mental unsoundness, but the patient is not a proper person to be removed from his home or sent to an asylum. In cases of insanity, the patient being at liberty, there may be difficulty in gaining access to him and making an examination. This difficulty may come from the patient himself or from his ill-judging friends, who may dread to have it known that insanity is in the family, or who may have a strong prejudice against asylums. They particularly dread the notoriety and the feared disgrace of having their friend in a mad-house. The insanity may be denied, or the plea that the patient is not dangerous to himself or others, and that he only needs rest or restoration from some temporary ailment, is likely to be made. There is sometimes difficulty, and not unfrequently danger, from the patient himself. He may be apprehensive that the physician intends to do him harm, and may be armed with deadly weapons. No precise rules of procedure can be applicable to all cases. Stratagem should be avoided, if possible, as the insane are often quick to detect deception, and it is of great importance to secure their confidence and respect. The friends and attendants should see that the patient is not armed. Every instrument that may readily inflict injury upon himself or others should at once be secured whenever insanity is manifested. When access to the patient is obtained (and often he is brought to the physician), conversation should be commenced, and the examination should be proceeded with in as quiet a manner as possible. The patient may give his own medical history, or it may be obtained from others, and often it is better not to do this in his presence. If his history and peculiarities have previously been known to the physician, a diagnosis can be more readily made. The statements of others are often *ex parte*, and must be received with caution.

The patient's appearance must be noted, his particular physical symptoms observed, his alleged delusions verified, and his perverted feelings and impulses inquired into. There must be no effort by cross-questioning to make him "lose his head," but a fair and careful examination should be made to ascertain his exact state of body and mind. When there is a morbid propensity to drink, the question will be whether it is an ordinary depraved appetite produced by previous indulgence, or a form of real insanity which has received the name of *Dipsomania*. This subject has already been referred to under the head of alcoholism. Various forms of insanity—mania, melancholia, and dementia—may be caused by drink, as well as this particular form

of dipsomania, and the propriety of restraint in an asylum, or of giving a certificate of insanity, will depend upon the view taken as to the fact of the existence of *disease*, its extent, and the means necessary for its proper management.

When the two questions are settled in the mind of the physician—that the person is insane, and that his interest and that of his friends and the public will be subserved by his removal to an asylum—it becomes his duty to give his certificate to that effect.

In cases of idiocy and dementia there is not the same necessity for an asylum residence. These persons, with ordinary care, are not usually dangerous to themselves or others. No treatment with them can effect a cure, and idiots are excluded from many asylums. It will be a question in cases of dementia, after considering the state of body and mind, and the home care the demented are likely to receive, whether their condition will be improved by their being sent to an asylum. As to their property, they are to be treated as minors, and so long as they are properly cared for they may be left with their friends.

In cases of mania and melancholia the physical condition of the patient may be such as to forbid the removal to a distant asylum, and some whose insanity is not extreme, especially young and hysterical persons, would be so shocked to be taken to an asylum and placed among other insane persons that such removal is far from desirable. A quiet retreat in the house of a competent physician, or other person familiar with the insane, may be much better than an asylum life, which to some has a degrading influence.

It will thus be seen that the simple fact of insanity does not necessarily require that the patient should be sent to an asylum. In most cases of general mania, or melancholia with much depression, an asylum is necessary. Such patients cannot be properly treated at home.

If the insanity arises from domestic causes, removal from former associations is imperative. There may be exceptions, but generally a patient should be removed from those with whom he has had intimate associations, and especially from those he has been accustomed to govern, and he should, as a rule, be placed in new personal relations. Even where there are facilities for home treatment—experienced nurses, safe apartments, judicious medical attendants, etc.—family and friends must be excluded, and a different mode of life established. Where, then, it seems objectionable to introduce a patient into the society of the insane in an asylum, still, removal from home is generally necessary. At all events, the patient must be in the care of persons who are judicious and accustomed to the management of the insane.

It is very seldom that the proper conditions can be found outside of an asylum ; and the asylums of this country are so ample in their arrangements and so well managed that, as a rule, the insane should be sent to them. In most cases the duty of the physician is plain. If a patient is furiously maniacal ; if desperately suicidal or homicidal, or dangerous to others by reason of delusions which lead to acts of violence ; if impatient of restraint, resisting or eluding it ; if persistently refusing food ; if epileptic and sullen and suspicious, there can be no question of the *necessity* of asylum care and treatment. As soon as the object can be properly accomplished, the patient should be placed in the care of a specialist in the disease, when the responsibility of the family physician ceases.

Wherever the patient is placed, certain indications in management are presented. The removal of any cause still operating is, of course, desirable. Any bodily disease, whether of the brain or other organs, though merely concomitant, must receive attention, and be treated according to its indications. If constipated bowels—an overloaded colon—be present, a decided cathartic may be demanded. Purgation with hellebore was a favorite mode of treatment with the ancients, and though such treatment has fallen into disuse, there are, doubtless, cases where a few aloetic or other cathartics may be of decided service. Former abuse of cathartics, if it were such, is no reason for present neglect. The general condition of the system must be taken into the account, but whatever local or general derangement may be observed must, if possible, be removed as in other cases.

With regard to the special condition of the brain constituting the insane state, these indications seem to be presented, viz.: to allay its irritability, to prevent its exhaustion, and to improve its nutrition.

For fulfilling the first indication blood-letting was formerly much practiced, but modern opinion among alienists is very strongly against it. It is found that though in some cases excitement may be temporarily diminished, exhaustion, which is always to be guarded against, is hastened, and often great mischief is done. In many cases the loss of blood fails to produce temporary relief, and may even, by diminishing inhibitory functions, increase the excitement. As a general practice it is therefore to be condemned ; but cases can be conceived of where an overfullness of the system is present, and where congestion of the brain is so decided that the abstraction of blood, either by venesection or by cupping or leeching, might not only be justifiable, but demanded. In practice such cases are so seldom met with that the complete laying aside of the lancet in insanity is very generally advised.

Where the head is hot and congested, cold may be applied and de-

rivatives may be used as in other cases of congestion, care being taken that the patient be not too much depressed or debilitated by any means that may be used. A warm bath or a pack will often allay irritation and excitement. While the patient is in the warm bath cold may often be applied to the head with advantage. These means are more frequently resorted to on the continent of Europe than in England or this country, and their beneficial effects in many cases cannot be questioned. The bath may be continued at a comfortable temperature for some hours, but its effects must be observed. Capillary congestion is relieved, a soothing impression is made upon the whole system, and the patient often falls asleep in the bath or the pack. These baths may be repeated as occasion requires.

Rest in bed in the beginning of an attack is often useful. It may be difficult to induce the patient to take to the bed, and absolute force should be used as little as possible. Persuasion and firmness—a calm exercise of authority—will often be yielded to by one that is furious. In many cases, particularly at a later period of the disease, muscular exercise, especially if with some object and purpose, will work off the excitement, but extreme activity may produce exhaustion and should often be controlled. From the intense preoccupation of the mind the calls of nature are often neglected, and the evacuations must be inquired after and often promoted.

The combined effect of a warm bath or a pack, a cool sponging after, followed by drying off and a rest in bed, will often be of great service. As already intimated, the patient should have constant attendance, especially if at home and not in a secured room, and if possible by persons skilled in the care of the insane. There should be simple surroundings; mechanical restraint should, if possible, be avoided, but in some cases this can only be done when enough attendants can be obtained to prevent accidents. All persons specially disagreeable to the patient, and whose presence causes excitement, should be removed.

The management of food is important. Occasionally the appetite is ravenous. It should then be restrained. Often the patient is not inclined to take much nourishment, and sometimes he refuses it entirely. It must in some cases be forcibly administered. The best method is by introducing a small elastic tube through the nostril, extending it into the pharynx, and sometimes farther, and injecting liquid food with a syringe. A stomach-pump may be used for the same purpose. More or less force in such cases will be required.

For quieting excitement, procuring sleep and rest, and thus endeavoring to prevent exhaustion, various sedatives and narcotics have been recommended and are used. Among these articles long in use are

opium—more especially morphine hypodermically—henbane, hyoseyamus, conium maculatum, cannabis Indica, hydrocyanic acid, digitalis, and tartar emetic. There are differences of opinion as to the positive and comparative value of these articles, but that each of them can occasionally be used with advantage there can be little doubt. Whichever of these articles is selected, it must be used with discrimination and adapted in dose and time to the particular conditions of each case.

Recently the bromides, chloral hydrate, chloroform, codeia, and particularly hyoseyamine have been used for the purpose of calming excitement, procuring rest and sleep, and improving the conditions of the mind. The bromides have for some time past been popular remedies in various nervous diseases, as we have seen, and they still sustain their reputation. When long continued, in doses sufficient to procure rest, they often appear to produce a debilitating effect upon the mind and increase some of the phenomena of insanity. This impression seems to be general among alienists, and doubtless has a foundation in their experience. The objection does not hold as to their occasional use or their continuance for a shorter time; and when sexual excitement is marked they are indicated. Their discriminative use is therefore to be commended. Chloral hydrate is a powerful soporific, and may occasionally be used to procure sleep. Its use, however, is not without danger, and the amount of good done by the enforced sleep it produces is by no means established. It, too, must be used with much caution and with discrimination. A habit of taking this, as of other similar articles, may be established. Much the same may be said of the inhalation of chloroform. It has but a limited range of application in insanity.

Codeia has been used as a substitute for morphine, particularly in cases of melancholia. It is thought to stimulate or modify favorably the conditions of the intellectual centres, without causing loss of appetite, constipation, or derangements of secretions, and is advised where there is great restlessness in consequence of delusive apprehensions, and where food is refused. It mitigates the painful consciousness so frequently present in many cases of insanity.

The *citrate of caffeine* has been thought to be useful in cases of melancholia, especially when accompanied with anæmic headaches and active delusions of apprehension. Its use must be continued for some time in order that its beneficial effects may be fully realized.

A great favorite at the present time in many of the insane asylums of this country is *hyoseyamine*. The amorphous preparation of Merek is used in doses of $\frac{1}{12}$ to $\frac{1}{10}$ of a grain, and from this quantity quite marked physiological effects are produced. It is thought to differ in its action in several respects from *hyoseyamus*. Its effects are

more decided upon the muscular system and upon the cerebral centres, without irritating as much the stomach and bowels. It sometimes produces a staggering gait, or even inability to stand. At first it increases the blood pressure; but later, as its hypnotic effect is manifested, the blood tension is diminished. An overdose causes irregularity of the heart's contractions. The system soon becomes accustomed to its use, so that larger doses are required. It is said that if the first few doses fail to produce beneficial effects its longer continuance is not likely to be useful. Its usefulness is chiefly manifested in cases of acute mania with great mental and muscular activity, with sleeplessness, flushed face, and contracted pupil, where there is ceaseless and incoherent talking with complete loss of self-control. After a few full doses the patient often becomes quiet, his conversation is more coherent, and his more marked insane condition is often removed. It is stated as the result of experience that "the succession produced in a mind muddled with delusions and hallucinations by the antagonism of new forms of mental aberration, together with the subsequent deep and prolonged sleep produced by hyoseyamine, might tend to leave the mental state more composed, after the artificially produced delusions and hallucinations have passed away." (Dr. Lawson.) It seems to act on the common principle of supersession—substituting one action for another, the latter subsiding as the more direct effect of the agent disappears. Hyoseyamine seems from all the testimony to be more efficient than any other drug in calming the excitement of acute mania, and of those violent outbursts which are likely to occur in more chronic cases. It will, therefore, be a proper article to be prescribed by the physician called to an acute case, and before there is time for removal to an asylum, as well as for use in asylums. In a majority of cases of chronic mania its effects are transient; in some, however, its prolonged administration seems to produce more permanent effects. In rare cases it appears to increase the morbid excitement, and has to be discontinued.

Exhaustion is a state to which all the active conditions of insanity tend. When occurring, nervous and cardiac stimulants are indicated. Digitalis, while soothing nervous irritability, often produces a decided effect as a cardiac stimulant, and combined with tonic doses of quinine, iron, or strychnine, or, in fact, with all these together, a happy effect is often produced. Proper nourishment here, as in all cases of exhaustion, is of the first importance; and for proper nutrition not only food, but the power of digesting and appropriating it is essential, and when this power fails every possible measure for promoting it becomes important.

As a rule, chronic cases need supporting treatment. There should

be a combination of measures—nutritious food, fresh open air, bathing, exercise, codliver oil, phosphites, and various tonics.

In insanity, as in every other disease, acute and chronic, attention to the state of the digestive organs is important. The bowels should be kept open, the secretions regulated, and an occasional blue pill followed by a laxative will often be of essential service. The condition of the urine should not be neglected, and when oxaluria or any other morbid condition is ascertained, appropriate treatment should be instituted.

But morbid processes are going on in the brain in cases of insanity, and it should be considered whether any means can be used for their arrest. The alterative effects of the preparations of iodine would naturally be suggested, and so might those of mercury, but experience has not demonstrated their efficacy. When other diseases exist, such as syphilis, gout, rheumatism, consumption, etc., causing specific changes of nutrition, they must receive the treatment their conditions demand.

As will be inferred, *there are no specifics for insanity*, and, as in other diseases, rational principles must be followed.

But the medical treatment, however judicious, will be of little avail if not supplemented by proper general management—by what is called *Moral Treatment*. As this is generally conducted by specialists and in asylums, no detailed account of it will here be attempted. Kindness, not only on principles of humanity but in reference to success, is an essential element in the management of the insane. Discipline is also essential, but it must be administered with humanity and justice, and with reference to the interests of the patient. The insane, like others, are more or less influenced by rewards and punishments. Expected or promised rewards should never be neglected, and the punishments, which as a rule should only be in the form of deprivations or restraints, should be kindly and judiciously inflicted.

In this moral management the great object should be to rest those faculties which are excited and overwrought, and properly exercise and develop those which are feeble or in abeyance. A life of regularity and system should be instituted, in place of confusion and disorder. It is seldom an insane person can be reasoned out of his delusions, and such attempts are often worse than useless. His mind should rather be diverted from the subjects upon which he dwells, by substituting, as far as possible, other thoughts and pursuits. Amusements are often important, and employments for those at all capable of pursuing them are of the greatest service. Severe labor, however, can seldom be endured, and it must be adapted to the strength, the capacity, and the previous position and customs of the patient.

An insane person, though more or less alienated from himself, is still a human being, and must be treated as such. Everything good and rational within him must be appealed to, while the evil is discouraged and suppressed.

HUMAN PARASITES.

A Parasite is a distinct organism, inhabiting and subsisting upon another organism.

There are large numbers of parasites which infest the human body, some familiar in their character, with well-known pathological relations to it, and others without such defined relations. An enumeration and description of all the known parasites would extend this article beyond the limits which can be properly assigned it, and only those will be particularly referred to which are well known, and occur with such frequency as to be of practical interest to the physician. Several of these have already been mentioned in connection with the diseases of the particular organs in which they are found. No further special description of them will be given.

Human parasites include both *Animal* and *Vegetable* organisms. A great variety of classifications or descriptive arrangements are made by different authors, which it will be unnecessary to enumerate. Those infesting the internal parts of the body—the parenchyma of the deeper organs or their cavities—are called *Entozoa*. Those occupying the surface, or parts not below the thickness of the skin, are called *Epizoa*.

The injurious parasites produce their effects either by withdrawing nourishment from the body, by inducing inflammation or other morbid changes by their presence, or by causing mechanical injury or irritation. The subject of the influence of minute organisms—of *bacteria*, etc.—in exciting chemical and physical changes and in producing specific diseases, has been repeatedly referred to in connection with such specific diseases, and has been sufficiently discussed.

Animal Parasites are divided into three general classes—the *Protozoa*, *Arthropoda*, and *Vermes*.

The protozoa are the lowest in the scale of organization of the animal kingdom. The *Infusoria* belong to this general class, and are frequently found in the contents of the alimentary canal and other mucous cavities, but they have not been demonstrated to be the cause of disease. The arthropoda, embracing the *Arachnida* and *Insecta*, usually infest the skin. The *Acarus folliculorum*, found in sebaceous follicles, is without pathological importance; but the *Acarus scabiei*,

which causes the itch, and the insecta, embracing the different species of lice—the *Pediculus capitis*, the *pediculus Pubis*, and the *Pediculus vestimenti*—are well known.

The parasites belonging to the division of *vermes*, or *worms*, are the most common, and the largest of the organisms infesting the body, and some of them will require particular notice.

Some of these entozoa occupy the intestinal tube, and some are found outside of this cavity. The parasitic worms are divided into the *Nematoida*, or round worms; the *Trematoda*, or *suctorial* worms; and the *Cestoda* or *Tæniadæ*, which include the tape-worms. The nematoida, or round worms, generally occupy the small intestines; the *Oxyuris vermicularis*, commonly known as the pin-worm or seat-worm, is found in the rectum or colon; the *Tricocephalus dispar* is oftenest found in the cæcum; the *Anchylostoma duodenale*, in the duodenum; and the *Anguillula stercoralis* inhabits both the intestines and bile ducts. These are all intestinal. Those outside of the alimentary canal, belonging to this class of round worms, are the *Strongylus gigas*, found in the pelvis of the kidney; the *Trichina spiralis*, in the muscles; the *Filaria medinensis*, or Guinea-worm, found in the areolar tissue; and the *Filaria sanguinis*, found, in some tropical regions, in the blood.

The *Cestoda* or *Tape-worms* include the *Tænia solium*, the *Tænia mediocanellata* or *saginata*, the *Bothriocephalus latus*, besides some rarer forms of fully developed worms, all inhabiting the intestines. Immature cestoid worms, or worms in an undeveloped stage, are the *Cysticercus cellulosæ*, the scolex of the *Tænia solium*, and the *echinococcus* or *hydatid*, and the scolex of the *Tænia echinococcus*. This is a small tape-worm which infests the dog, but the ova of which develop in the human liver, lungs, and other situations. Under the head of the *Trematoda* are included the *Distoma hepaticum*, found in the biliary ducts, and the *Distoma hæmatobium* in the portal veins. The eggs of these worms may be in other situations—in the kidneys, bladder, and intestines.

The *Vegetable Parasites* are mostly developed on the surface (epiphytes). They include the *Fungi* and the *Bacteria*. Various fungi are found in connection with, and are the causes of, skin diseases, and are usually described in connection with these affections. The *oïdium albicans* is a fungus found in thrush and has been referred to. The *Sarcina ventriculi* has also been spoken of as found in vomited matters in some forms of dyspepsia. *Mycelia* are generally present in the mouth, but seem to have little or no pathological importance.

This is but a brief synopsis of the more important parasites, more

full accounts of which might be interesting; but for these the reader must be referred to special works on the subject.

The Intestinal Parasites are of most interest to the general practitioner, and will require more particular notice.

The *Origin* of these parasites is in some cases obscure, but the discussion of questions of origin belongs to the general subject of biology, and need not detain us with its details here. It is sufficient to say that, according to our present knowledge, parasites, like all other living beings, derive their existence from preceding organisms through germinal matter issuing or detached from their substance. Spontaneity in generation is unproven, and the law that like begets like still prevails. It is generally admitted that the ova of intestinal parasites are conveyed into the alimentary canal from without, and that those organisms have had a previous existence in some animal body. Hence those who are brought much in contact with animals, dead or alive, in which such ova abound, or who eat raw meat, are especially liable to have these parasites. A want of cleanliness, and careless habits as to food and surroundings are factors in the causation of parasitic affections.

Symptoms.—Intestinal parasites are capable of producing a variety of symptoms, but effects are often attributed to them which are the results of other causes.

The symptoms they produce are those of irritation and sometimes inflammation of the digestive tube, and various reflex phenomena appear in distant parts of the body. The presence of parasites in the intestines to a moderate extent is not, however, necessarily incompatible with health. Worms are not unfrequently passed by persons unconscious of any ailment; but when large numbers or certain kinds of worms are present in susceptible persons, or when the intestines from any cause are in a diseased and irritable state, severe symptoms may result. The local symptoms are pains and uneasy sensations in the abdomen, disorders of digestion, a variable appetite, irregularity of the bowels, tumefaction of the abdomen, and itching about the anus. The more remote or systemic symptoms, the result of reflex action, are thirst, salivation, cough, laryngeal spasms, disorders of the senses, tickling of the nose, starting in sleep, grinding of the teeth, paleness about the mouth, feverishness, and in children especially, convulsions. These symptoms, however, may be produced by irritating impressions made upon the intestinal membrane by various other conditions—by improper food, perverted secretions, constipation, or by hyperæmia or inflammation of the intestinal membrane. There may be much presumptive evidence of worms, but the only positive proof of their existence is their appearance. The symptoms really pro-

duced by them are more dependent upon the susceptibility of the person affected than upon the number, size, activity, or position of the worms. These circumstances, however, all have their influence. The most characteristic feature of worm symptoms is their variability, depending upon the activity of the movements and the changes of position of the worms. Errors of diagnosis as to worms in children are often made, especially by their nurses, mothers, and friends, and formerly much more frequently by physicians than now, who attributed to worms what was due to other causes. It is possible that worms were more frequent formerly than at present, and it is certain that they prevail in some localities more than in others. The habits of the people have much to do in the causation, but climate has a marked influence. Intestinal worms are more prevalent, at least the lumbricoides, in the Southern than in the Northern States of our Union.

ASCARIS LUMBRICOIDES, OR THE COMMON ROUND WORM.

This is the most frequent of the Nematoida, or, in fact, of all the worms, especially in children. It resembles in size and appearance the common earth-worm more than do any of the other entozoa, and is so often seen that a particular description of it is not required. It has prevailed in some localities and seasons as an epidemic.

The ova of this worm resist unfavorable conditions, such as freezing and high temperature, and are thought to retain their vitality for years. The principal mode of receiving them is in drinking water. The ova are passed from the intestines of those infested with the worms, and when the excreta obtain access to wells or springs, the minute germs are taken in the water, and develop in those intestines where the conditions are most favorable to them. These seem to be in the intestines of children, and of those badly fed and cared for. Climate, external surroundings, and habits contribute to the result, and it is possible that the habits of the large number of the colored people and the lower class of the population of the South have more to do than the climate in producing the greater number of these cases in that region.

The number of these worms existing in the alimentary cavity varies exceedingly. There may be a single one or many hundreds. They may be rolled together, occluding an intestine, or so numerous as to greatly distend the abdomen. Their chief habitation is in the small intestines, but they frequently pass into the large, and sometimes into the stomach, the œsophagus, the biliary ducts, the mouth, the nose, and even into the Eustachian tube. Females are said to be more subject to them than males, and they are more common between

the ages of one year and twenty. Feeble, lymphatic, and strumous children, poorly fed, are more subject to them than others. It is thought that the period of their developed life is usually not more than a year, but the knowledge on this subject is imperfect.

The sexes of these worms are in different individuals ; the female is somewhat larger than the male, and the latter is distinguished by the tail being turned toward the abdomen like a hook. The eggs are slow in development after their expulsion from the worm, are encased in a firm shell which protects them from injury, and they retain their vitality for years.

Symptoms.—The symptoms produced by the round worms, when they cause any symptoms, are essentially those which have been mentioned as belonging to worms in general. When the worms are numerous or the patient is susceptible, and especially when the intestines are suffering from catarrh from whatever cause, severe symptoms may be induced. The usual symptoms are restless nights, terrors, or grinding of the teeth in sleep ; colicky pains ; capricious appetite ; mucous and sometimes bloody or diarrhoeal stools ; sometimes nausea and vomiting ; whey-like urine ; discoloration under the eyes ; dilatation and sometimes inequality of the pupils ; irregular pulse ; itching of the nose ; and spasmodic seizures. All these symptoms are liable to speedy exacerbations and remissions ; and no one of them, nor all of them together, will afford positive proof of the presence of the worms. A certain number of them, however, taken together will furnish sufficient presumptive evidence to justify the use of vermicide remedies.

Treatment.—Various medicines are capable of destroying the common round worms, or of depressing their vitality and leading to their expulsion.

The true vermicides act directly upon the worms, killing or so affecting them as to diminish their resistance to the peristaltic motion of the intestines, which results in their expulsion. Indirect vermifuge medicines are those which exert their influence on the alimentary canal, increasing the expulsive action, so as to dislodge them from its cavity. Frequently a combination of these agents is used.

Among the vermicides proper the *santonine*, the active principle of *Artemisia santonica*, is at present most used. Besides its efficacy it has the advantage of having but little taste, and made up with sugar and gum into lozenges it is easily administered. It affects, in free doses, the vision of the patient, causing objects to appear of a yellow color, and it causes yellow-colored urine. It is recommended to be given in doses of from two to four grains at night, rubbed up with sugar or liquorice powder, or in form of a lozenge, followed by a laxa-

tive or a cathartic the next morning. In overdoses it causes violent nervous symptoms, and care must be taken that in poisoning the worms the patient is not poisoned also. Where a freer dose is given a cathartic should follow in a short time, and as a rule, but a few hours should elapse between the santonine and the cathartic.

When from the symptoms and the character of the discharges there is reason to suppose there is much mucus in the intestines which may envelop and shield the worms, it would be well to give a laxative before the vermicide is administered—or the santonine may be repeated after the cathartic following it has operated.

Calomel is not unfrequently efficient in removing these worms. It was formerly a favorite remedy for this purpose, and is not unfrequently still given in connection with the santonine. It likewise should be followed by a cathartic—at least a cathartic effect should be secured when it is given.

The *Chenopodium anthelminticum* is another anthelmintic. It is usually given in the form of oil, in doses of five to ten drops in an ounce of castor-oil, or combined with some other vermifuge, and followed by a cathartic.

The *Spigelia*, or *Pink-root*, is an old and valued anthelmintic. Given in combination with a cathartic, as in the following formula, it will generally expel lumbricoides when they are present.

℞	Spigeliæ,	
	Sennæ.....	āā ʒ ss
	Magnesiae Sulph	ʒ ij
	Fœniculi.....	ʒ j
	Aquæ Ferventis.....	Oj

Macerate one hour in a covered vessel. Dose—A table-spoonful to a child of two years, once or twice a day.

The fluid extract of spigelia and senna in appropriate doses is of equal efficacy. Or,

℞	Fluid Ext. Spigelia and Senna.....	f ʒ j
	Santonine.....	gr. ij
	M.—One teaspoonful to a child five years old.	

Oil of turpentine is another useful remedy, combined with castor-oil in free doses, or in smaller doses combined with mucilage, or in emulsions where diseased conditions of the bowels require its more protracted use.

Where symptoms that are equivocal are present, and the diagnosis is not clear, vermifuge medicines, if used at all, must be of the milder

kind, or those that will not irritate the intestines if no worms are found. There is often more "worm-hunting" than is profitable or safe.

OXYURIS VERMICULARIS.—THREAD-WORM.—PIN-WORM.—SEAT-WORM.

This worm, often called *Ascaris vermicularis*, or simply "*ascari-des*," is a small worm, the female scarcely half an inch long, and the male only about half the length of the female. Their seat is the large intestine, and especially the rectum, and often the ova and the worms themselves are found outside of the intestine in the folds of the skin about the anus; and in females they are sometimes found temporarily in the vagina.

The chief symptom is itching and irritation of the parts, though sometimes pain is induced; and the diagnosis is not difficult, as the worms usually make their appearance in the evacuations, or in crawling about externally. They produce an abundance of ova and multiply rapidly, and are usually present in great numbers. The ova may retain their vitality long, but they develop more rapidly when retained in the intestine than the ova of the lumbricoides. The worms are perhaps most frequent in children, though they occur at all ages.

The **Treatment** is simple and certain if thoroughly applied and persevered with. When the worms, as is usual, are nearly or quite all located in the rectum, injections of one of the following fluids, repeated and continued for a sufficient length of time, will accomplish their removal. A decoction of quassia, or aloes, or simple lime-water, will generally answer the purpose. A weak solution of carbolic acid, the sulphide of potassium, hyposulphite of soda in free quantities, or common salt, or chlorate of potash, will be still more efficient. At the same time a vermicide in an ointment with lard, such as some preparation of mercury, or safer and perhaps as effectual, an ointment of salicylic acid, should be thoroughly applied externally and rubbed into the folds about the anus. It not unfrequently happens that treatment temporarily successful will be followed in some days or weeks by the return of a horde as large as before. This is due either to the fact that some worms higher up in the intestine were not reached by the injections and have multiplied, or that ova were left which were not destroyed or expelled, and which subsequently developed. It is proper in such cases to use some internal vermifuge, such as santonine or pink-root and senna, obtaining cathartic effects, and then immediately to repeat the injections whenever worms appear, so as to destroy the new brood before they discharge more ova. This course, destroying carefully all external ova, will be effectual and certain where there is the proper perseverance.

The *Tricocephalus dispar* is far less common than the other intestinal worms just mentioned. As its name indicates, there is a hair-like appearance of its cephalic end. The worm is from an inch and a half to two inches in its entire length; and as with the preceding, there is a male and female, the male somewhat shorter and more curved than the female. This worm is seldom found elsewhere than in the cæcum, and is very seldom in numbers sufficient to cause symptoms. The clinical features of cases where this worm exists are unknown, and a diagnosis would usually be impossible. Treatment, where the worm is suspected from irritation in the cæcum, would not differ from that required for lumbricoïdes.

TÆNIA, OR TAPE-WORMS.

Much light has been recently thrown upon the natural history of the *Cestoda*, or tape-worms, and the development of most of them through the different stages of their curious existence has been traced. The *Tænia solium* and the *Tænia mediocanellata* or *Tænia saginata* (a slight modification from the *Tænia solium*, which has only recently been recognized), are the most common forms of tape-worm found in the human subject, and are well known to have a previous existence in the *Cysticercus cellulosæ*; and the smaller tape-worm found oftenest in the dog—the *Tænia echinococcus*—is as well known to exist in a very different form from its full development in the *hydatids* of the human liver, lungs, and other organs.

The mature worms discharge ova in the intestinal canal which they inhabit. It is fortunate that these ova do not develop there, as is the case with the round worms, since it is intimated that the number of ova produced by a single tape-worm of a cat is 12,500,000. These ova are of course very small, they pass off with the excrement and seek the continuance of their life elsewhere. Most of them perish, but now and then one finds its way into the stomach or lungs of an animal, occasionally of a human being, gets into the blood, is carried into the parenchyma of an organ—the liver oftenest—and there forms a cysticercus or an echinococcus, which in time obtains its liberty, and gets a lodgment in the alimentary canal of an animal or a man, and develops into a tape-worm. The cat, for instance, has a tape-worm which discharges its millions of ova. One of them gets into the stomach, and finally into the liver, of a rat. There it takes its first degree of development. The same cat eats the rat, including the echinococcus, and the latter takes its second degree of development into a tape-worm in the intestine of the devouring but now infested cat. A man has a tape-worm. An ovum from it gets into a pig or an ox.

It develops into a cysticercus. A portion of the pig or ox is eaten imperfectly cooked, including the immature parasite, by a man (some man) and in time he has a tape-worm. The practical deduction is, that to avoid such danger, which to be sure is remote, a man should not eat raw or imperfectly cooked flesh of a pig or an ox. The hydatids in the liver, etc., have already been discussed. We are interested now in the tape-worm in the intestines. This parasite, as its names imply, is characterized by its ribbon-like or tape-like form. It is a flattened, jointed, or segmented worm, each segment a few lines in length, but their great number, from a few hundred to one thousand, makes the worm several, sometimes many, feet in length.

The length of the *Tænia solium* varies from four or five to thirty-five feet. This worm tapers much at its cephalic extremity, its neck is long and thread-like, marked by rugæ, but not distinctly segmented, and the head is very small—not larger than a pin-head.

Examined by a magnifying-glass, it is found to have four projections or suckers, and a coronet of twenty-six hooklets, alternately longer and shorter, surrounding a projection called the rostellum. The joints of the inferior part, or caudal end of the worm, are often separated and thrown off in the stools, giving evidence of the presence of a tape-worm. The exfoliated joints contain ova in great numbers.

The *Tænia saginata* is quite as frequent as the *Tænia solium*. It differs from it in having thicker and longer joints, and the head, though it has the four suckers, has not hooklets or a rostellum. The generative foramina, which are in the different segments, are alike in both, and the general appearance and habits of these worms strongly resemble each other. Their differences are of no practical importance.

The *Tænia lata*, or broad tape-worm, has other peculiarities. Its joints are broader than they are long, the genital orifices, different from those of the *solium* and *saginata*, are in the middle of the joints, and its head is of a different conformation. It is elongated instead of being rounded, and instead of the suckers it has two longitudinal depressions, giving it the specific name of *Bothriocephalus*. It may attain even a greater length than the other form.

There is another variety of tape-worm, which has been found to infest the people of North Greenland, but which has not been found in this country; and the *Tænia lata* has chiefly been found in Russia, Switzerland, and Ireland. It is thought by some that this worm comes from a cystic entozoon existing in fish, while others think the ova taken in drinking water are capable of development in the intestines into worms, without going through the stage of cystic development in solid tissues.

“Measly” pork contains the *Cysticercus cellulosæ* in great num-

bers, capable of producing the *Tænia solium*, and in beef are contained the cystic germs which produce the *Tænia saginata*; and these are the usual sources of the common tape-worms in this country, in England, and in Germany. Thorough cooking destroys these organisms. The treatment of cholera infantum with seraped raw beef is thought to have been the cause of an increase in the numbers of *tænia saginata* within recent years. In regions where measly pork or beef is eaten raw or underdone, tape-worms are common.

The tape-worm occupies chiefly the small intestines, though when attaining a great length it often extends into the large. It may occur at any age, but is more frequent in persons from twenty to forty. Prof. Armor reported a case occurring in Detroit, where an infant five days old passed segments of *tænia*.

If there was no mistake about the case (and it seems to have been carefully observed), the germ must have passed from the blood of the mother to the fœtus at a comparatively early period of fœtal life in order to a development at that period of extra-uterine existence.

Tape-worms are not very frequent in this country, and yet most practitioners occasionally meet with cases.

The **Symptoms** are those common to intestinal worms in general. They are very slight in some persons, the discharge of segments sometimes being the first intimation of anything wrong. In other cases the symptoms are marked. Disorders of digestion, a variable appetite, uneasiness and pain in the bowels, emaciation, and a variety of reflex phenomena may result. Among the latter are headache, vertigo, disturbance of vision, and various general uncomfortable sensations; and when a worm is known or suspected to exist, the imagination often aids in the production of many symptoms.

None of the general symptoms enumerated are exclusively characteristic of tape-worm, and the positive diagnosis is made only by the external appearance of segments of the worm. Hypochondriacal patients with disturbances of digestion not unfrequently fancy themselves infested with tape-worms. An active cathartic administered without bringing away any segments of a worm will be presumptive evidence that none exists.

Tape-worms are long-lived, as cases are known where fragments have been passed from time to time for thirty-five years; but they die naturally sometimes, when a spontaneous cure will, of course, occur. The last remedy used may then receive undue credit. A considerable portion passing, but without the head or much of the small neck, is no evidence of cure, as reproduction by growth generally occurs. When the head is discharged a cure is accomplished, and if a very large part of the neck is discharged, though the head may not be

found, the worm generally perishes. A careful examination of the expelled part should always be made.

Treatment.—Prophylaxis consists in avoiding the eating of raw meat, or of meat much underdone, and care as to the drinking water used.

For the expulsion of the worm some preparatory treatment will be advisable, and then the administration of the taniafuge or the tape-worm poison. The preparatory treatment consists in the use of a light diet for a few days, and the administration of laxatives or mild cathartic medicines. The object of this is to clear away any mucous or other matters in which the worm may be imbedded, so that the vermifuge may the more effectually operate.

Various remedies have an injurious effect upon the worm and favor its expulsion.

Oil of turpentine is an old and sometimes a successful remedy. Doses as large as half an ounce, repeated a few times every half hour, or a larger quantity at once, have been advised. It may be combined with or followed by castor-oil. Sometimes small doses, repeated for several days, are successful.

The male fern (*filix mas*) has long been used, and is generally efficient. The dose of the liquid ext. is from gtts. x to 3i. Some prefer kousso, ʒss of flowers in water. An alcoholic extract under the name of koussoin has lately been used in doses of thirty grains; but it has failed with some, perhaps because the article was not of reliable strength. With others a free dose of pumpkin-seeds has been successful, and has the advantage of not irritating the patient. From ʒi to ʒijss, bruised in a mortar, may be taken in a short time, followed by some cathartic. Various compounds containing these and other ingredients are recommended by different physicians. Dr. M'Phail advises the following course, which I have no doubt will usually be efficient. Let the diet be light for twenty-four hours. Then give from ʒss to 3i of oil of *male fern* in ʒij of thin mucilage, and soon after a goblet of sweet milk should be taken. Two hours later give castor-oil, ʒi, combined in mucilage with 3i to 3jv of spts. turpentine.

Dr. Brinton advises the following :

Rʒ	Ext. Ether. Filicis Maris.....	f ʒ jss
	Pulv. Kamalæ.....	3 ij
	Mucilage Acaciæ,	
	Syrupi Simp.....	q. s.
	Aquæ Cinnamomi.....	ad f ʒ ij

M.—Half to be taken at bed-time, and half at 2 A.M.

The following has been used in the hospital and clinics of the University of Michigan with uniform success, in all cases where the previous passage of fragments proved the existence of a tape-worm :

R̄	Ethereal Ext. of Male Fern.	3 jss
	Kousso Flowers Pulv.	3 ij
	Confection of Senna q. s. for inducing a cathartic effect.	
	M.	

Let the patient fast for twelve or eighteen hours, and in the meantime give a dose of castor-oil. Then give one third of the mixture in a bolus, and the rest in two doses—one of them every half hour.

The head of the worm has not always been found, but nearly all the neck has been expelled, and, so far as heard from, the cure has been complete.

The preparatory treatment is often a matter of importance ; and whatever vermifuge is used, a purgative effect soon after should be secured.

Anchylostoma Duodenale is the name given to a worm discovered in 1838, in Milan, Italy, and since then its relation to a severe form of anæmia in Egypt, Brazil, and some other tropical countries, has been observed. The disease which it has been supposed to produce has a strong resemblance to “pernicious anæmia,” which was treated of in an earlier part of this work, and to which the reader is referred.

This worm is of moderate length, and is sometimes found in enormous quantities in the upper part of the small intestines ; and it has been thought to induce a tendency to “dirt-eating,” which is found to be present in some cases. The prognosis of the anæmia will depend upon the amount and the extent of the diarrhœa which usually accompanies it. The anæmia is said to sometimes cease spontaneously. The treatment consists in the administration of anthelmintics, and of iron and other tonics. In Brazil the juice of a tree called *ficis doliaria*, and an alcoholic extract from it called *doliarina*, have a reputation for removing the worm.

Phaladitis Genitalis is a name given to a microscopic round worm, lately discovered, inhabiting the female genital organs in a patient with advanced phthisis. The sexes of this worm are in separate individuals ; the females are a little larger than the males ; the latter have expanded wing-like tails, while the former have a more pointed caudal extremity. Their pathological importance is not yet ascertained.

Trichina Spiralis—Trichinosis.—This parasite was discovered in muscular tissue by Paget in 1835, and was described by Owen, but it was regarded as a mere pathological curiosity until 1860, when Zenker, of Dresden, showed that severe, and even fatal symptoms are sometimes produced by it; and since that time the “trichina disease” has been recognized and often described.

The trichina spiralis is found in striated or voluntary muscular tissue, in the form of a minute worm, about $\frac{3}{16}$ of an inch in length and $\frac{1}{16}$ of an inch in thickness.

Its anterior extremity is more pointed than its posterior, and it lies coiled up in the interior of an oval cyst, which is about $\frac{1}{16}$ of an inch in length. These cysts, with their parasite contents (and sometimes two, and rarely three, are in the same cyst, though very commonly there is only one), present the appearance of minute white grains, which on close inspection are visible to the naked eye, and on examination with a magnifying power are seen to have a lemon shape; and those that have remained some time have upon their surface, particularly at their ends, first a group of flat cells, and later granular calcareous matter. The number of these parasites varies greatly in different cases, but it is estimated that 20,000,000 may find harbor in a man of medium size. They are believed to be capable of retaining their vitality and remaining in these situations for many years, but they sometimes die and undergo calcareous changes.

Trichinæ have been found in the flesh of various animals besides man, but chiefly in the muscles of swine. Various examinations have shown that not a few of the carcasses of these animals brought to market, in this and other countries, contain more or less of these parasites; and it is chiefly from eating trichinous pork, rare or imperfectly cooked, that the disease occurs in man.

When trichinæ are taken into the alimentary canal, and the capsule in which they are contained is dissolved, the worms take on a more active life. They increase in size and rapidly attain sexual maturity. The female is twice the size of the male; they copulate, and the ova are developed in the uterus of the female worm, and living trichinæ are brought forth in great numbers, and at once begin active migration.

They eat their way through the walls of the intestines and to their destination in the muscles; or, what is more likely, they get into the lymphatics and blood-vessels and are conveyed to every part of the system. They select their places in the muscles, and coil themselves into the spiral form; the little sacs, which are not a part of themselves, form around them, and, if not disturbed, their comparatively passive but long-continued life begins. Experimental observations,

by introducing trichinous flesh into the stomachs of different animals, have shown that the results above described take place rapidly. The immature trichinæ taken into the stomach become mature in two days, and from the sixth day, and up to the end of the second or even third week, young trichinæ continue to be brought forth and commence operations upon the intestinal membrane. They reach their destination in the course of a week or two, and by the end of a month, or a little more, have come to their resting-places in the muscles.

Symptomatic Phenomena.—These are not uniform, but are generally characteristic and suggestive of the disease. As would be supposed, they are first those of gastro-intestinal irritation; then those of muscular irritation and inflammation, and accompanying these are febrile phenomena.

Within a few days after the ingestion of trichinous flesh, symptoms like those of enteric fever present themselves. There is thirst, loss of appetite, and sometimes stomach sickness, pains in the abdomen, generally marked, and constipation possibly, but more commonly diarrhœa. The tongue is coated, there is mental and muscular prostration, and emaciation comes on. The temperature is elevated, the heart's action is accelerated, and at this stage the disease is with difficulty distinguished from gastro-enteric fever arising from other causes. These symptoms increase in intensity for one, two, or sometimes three weeks, when they usually subside or culminate in a fatal enteritis or peritonitis. If, as sometimes happens, there is no suspicion of the cause of the disease, and repeated quantities of trichinous flesh continue to be taken, these symptoms might be much longer continued; and sometimes so much disease is induced in the alimentary canal that diarrhœa and other abdominal symptoms are the predominant morbid conditions for weeks, or even months.

While these abdominal symptoms are in progress, or sometimes after they have subsided, and as the emigration of the parasites and settlement of them in the muscles are taking place, pain, tenderness, stiffness, and swelling of these muscles, together with œdema of the subcutaneous connective tissue, copious perspiration in some cases, and an aggravation of debility, and febrile disturbance take place. The pains have some resemblance to those of rheumatism, but they are located in the course of the muscles and not in the joints. The muscles of the tongue may be so much affected as to interfere with articulation, and those of respiration so as to interfere with breathing. Dropsical effusions are apt to occur, often first in the face, particularly in the eyelids, and afterward in other situations. The temperature presents great variations during this later stage of the disease. In some cases it rarely rises above the normal, while in others it may go

up to 104°, 105°, and even 106° F. ; but it varies from day to day, and at different hours in the same day. In mild cases the patient may recover in the course of a month, in others six weeks or two months may terminate the active symptoms, while in others a much longer time will be required. The severity of the symptoms depends upon the number of trichinæ and the susceptibility of the patient.

M. Germain Sée, of Paris, distinguishes four clinical varieties of trichinosis. The *First* is the gastro-intestinal. Grave digestive symptoms occur. There is a sense of gastric distention, nausea and vomiting, and a diarrhœa, often profuse. These symptoms occur soon after trichinous food is taken—in from one to five days. The entozoa may now be discovered in the stools. There is free sweating and muscular prostration accompanying, and sometimes preceding, the diarrhœa.

The *Second* is the rheumatoid form. Muscular pains are now predominant, and exertion painful and fatiguing. In a week the muscles are swollen, hard, and tender—the flexors more than the extensors. A variety of particular symptoms may be produced by impairment of muscular functions. Gastro-intestinal symptoms have usually preceded this form or stage of the disease.

The *Third* is the œdematous form. The face, and especially the eyelids, are swollen, but disease of the heart and kidneys is absent. Gastro-intestinal symptoms and muscular prostration have preceded.

The *Fourth* is the typhoid form. This resembles in several respects enteric fever. There are pyrexia, prostration, dyspnœa, and muscular pains. There are also profuse sweats, œdema of the face, but the fever is brief though the other symptoms persist. This last is the gravest form. Delirium, and at length stupor, are apt to occur, and death usually takes place during the second or third week.

Death may occur from enteritis, peritonitis, or pneumonia, or from exhaustion caused by diarrhœa and the fever, or from the continued irritation of the muscles. When the trichinæ become encapsuled in the muscles, if not too numerous, all symptoms may subside. The pigs affected with trichinæ seem to fatten as well as others, and give no signs of the disease except on microscopical examination of the muscles.

The preceding is an account of the ordinary forms of the disease. There are, however, deviations from these types. A few years ago a German family, consisting of the father, mother, and one son about ten years of age, was sent from a neighboring city by a very intelligent physician to the Michigan University Hospital. All three had been suffering from disease for some three months. The phenomena at first were reported to resemble those of typhoid fever ; and an evident exposure to sewer gases from the repair of a sewer near them was very

naturally regarded as confirmatory of that view of the cases. The patients did not recover at the usual time for enteric fever; a diarrhœa which had existed from the beginning continuing uncontrollable, particularly in the case of the boy and the man. Both these were extremely emaciated, and without dropsical effusions, at least of any considerable amount. The case of the boy received more particular attention, as at the time of admission he was much the worst. By the use of the turpentine emulsion and astringent preparations of iron the diarrhœa was checked, but the prostration and emaciation continued, and at length the parotid glands became inflamed and suppuration of them took place, and a fatal termination followed. *No history of pain in the muscles was given, and none was experienced in either of the cases after they came under my observation.*

Trichinosis was not therefore suspected. On post-mortem examination of the boy, with the exception of that of the parotid gland, disease of the intestinal mucous membrane was alone apparent to the naked eye, and that was not sufficient to account for the result. The intestines showed evidences of previous rather than of present inflammation. Examination of the muscular structure with the microscope, however, showed trichinæ in immense numbers extensively distributed.

The father and mother, soon after the death of the boy, left the hospital; but I was informed that both died some weeks later, and that trichinæ were found abounding in each of them. The singular feature of these cases was that no muscular pains were ascertained to have been experienced from first to last. This led to an error at first in the diagnosis; and this history suggests the propriety in obscure cases of examining particles of the muscular tissues with the microscope. In the early stage an examination of the discharges from the bowels microscopically might discover the parent trichinæ, and later by extracting with a small harpoon portions of striated muscular fibre, the parasites, if found, would be positive evidence of the nature of the case. Examination of particles of muscles from several points would be required to afford presumptive evidence that there was an absence of trichinæ.

These are usually, however, very extensively distributed when present at all, and would be most likely to be met with even in a single specimen.

Treatment.—The treatment of trichinosis, in order to be efficient, must be instituted while the parasites are in the alimentary canal. After they have passed into the general system they cannot be reached by remedial measures, so far as is now known; and it remains to be ascertained by experience what measures even in this

early stage will be successful. Were it known that trichinous flesh had been taken, attempts at expulsion by cathartics would be called for; and the administration of medicines known to be capable of destroying other low organisms would be suggested.

Benzine has been given with the effect, it is thought, of destroying the parasite, without injuring the patient. Salicylic acid, carbolic acid, quinine, and the various vermifuge articles might act as parasitocides in this as in other cases.

Aside from these measures the treatment must be symptomatic, and with the object of enabling the system to endure the irritation until the trichinae become encysted. Measures to control an exhausting diarrhoea, to palliate the pain, and to support the powers of the system will be called for.

The value of the discovery of this disease consists in giving a knowledge of the means for its prevention, but not as yet for its cure. The preventive measures consist in the avoidance of raw pork, or of other raw meats. The process of pickling or smoking cannot be relied upon for destroying the trichinae. Raw ham and uncooked sausages cannot be eaten without danger. Haller states that the parasite is destroyed at a temperature of 155° F., and it is quite certain that at the boiling, the roasting, or the broiling point, if all the meat is brought to that temperature, the destruction of the vitality of the organism will be effectually accomplished.

Occasionally patients with stomach and intestinal derangements imagine themselves to be infested with animals not entozootic, such as lizards, snakes, slugs, etc.

While there is no proof that such animals have ever been developed or remained any length of time in the human stomach, it has been fully demonstrated by experiments that such creatures are incapable of living in the stomach of the dog and other lower animals. Prof. Dalton, of New York, introduced common garden slugs into the stomach of a dog, and found that they were dead in nine and one half minutes, and that no traces of them could be discovered when the dogs were killed an hour and a half later. The lizards were found perfectly dead and ready to undergo digestion at the end of fifteen minutes. Small snakes would be destroyed with nearly equal promptness, and it is proper to assure patients in the most positive manner, that the living of such animals in their alimentary canal is entirely impossible. Sometimes specimens are shown as having been discharged from the stomach or bowels, but these may be safely set down as cases of self-deception or of imposition. The larvæ of insects, however, have been known to be discharged from the nose, the mouth, and

other cavities. The ova may obtain access to these cavities and be developed into the larval state ; but when they are further developed into their ultimate insect form, which will soon take place, they can no longer exist, at least for any length of time, in such cavities. Animals that are not parasitic cannot long remain alive in the interior of the body.

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